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Nagashima et al.

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(45) **Date of Patent: Sep. 22, 2015**

(54) **CARTRIDGE AND PRINTING MATERIAL SUPPLY SYSTEM**

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(73) Assignee: **Seiko Epson Corporation**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/277,927**

(22) Filed: **May 15, 2014**

(65) **Prior Publication Data**

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(30) **Foreign Application Priority Data**

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Feb. 12, 2014 (JP) 2014-024059

(51) **Int. Cl.**
B41J 2/175 (2006.01)

(52) **U.S. Cl.**
CPC ***B41J 2/17523*** (2013.01); ***B41J 2/1752*** (2013.01); ***B41J 2/1753*** (2013.01); ***B41J 2/17513*** (2013.01); ***B41J 2/17553*** (2013.01)

(58) **Field of Classification Search**
USPC 347/86
See application file for complete search history.

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2012/0249693 A1 10/2012 Mizuno

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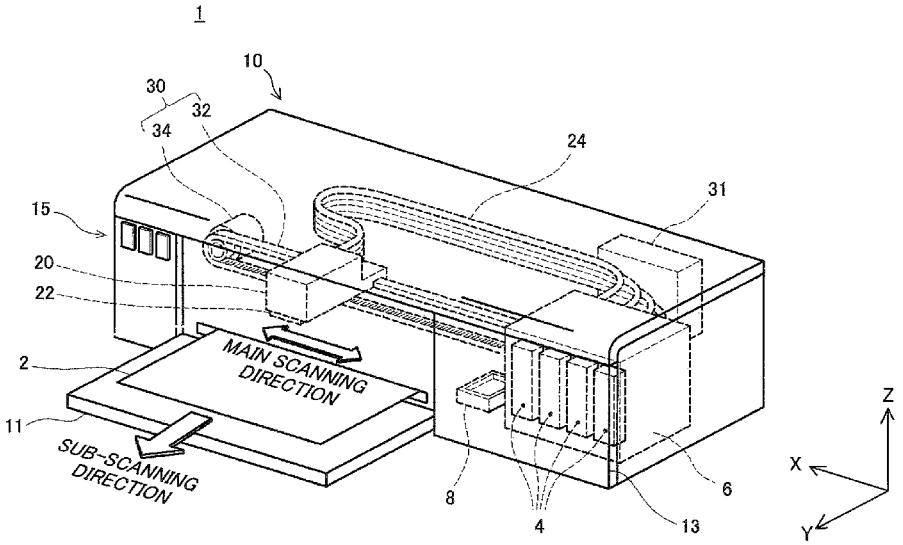
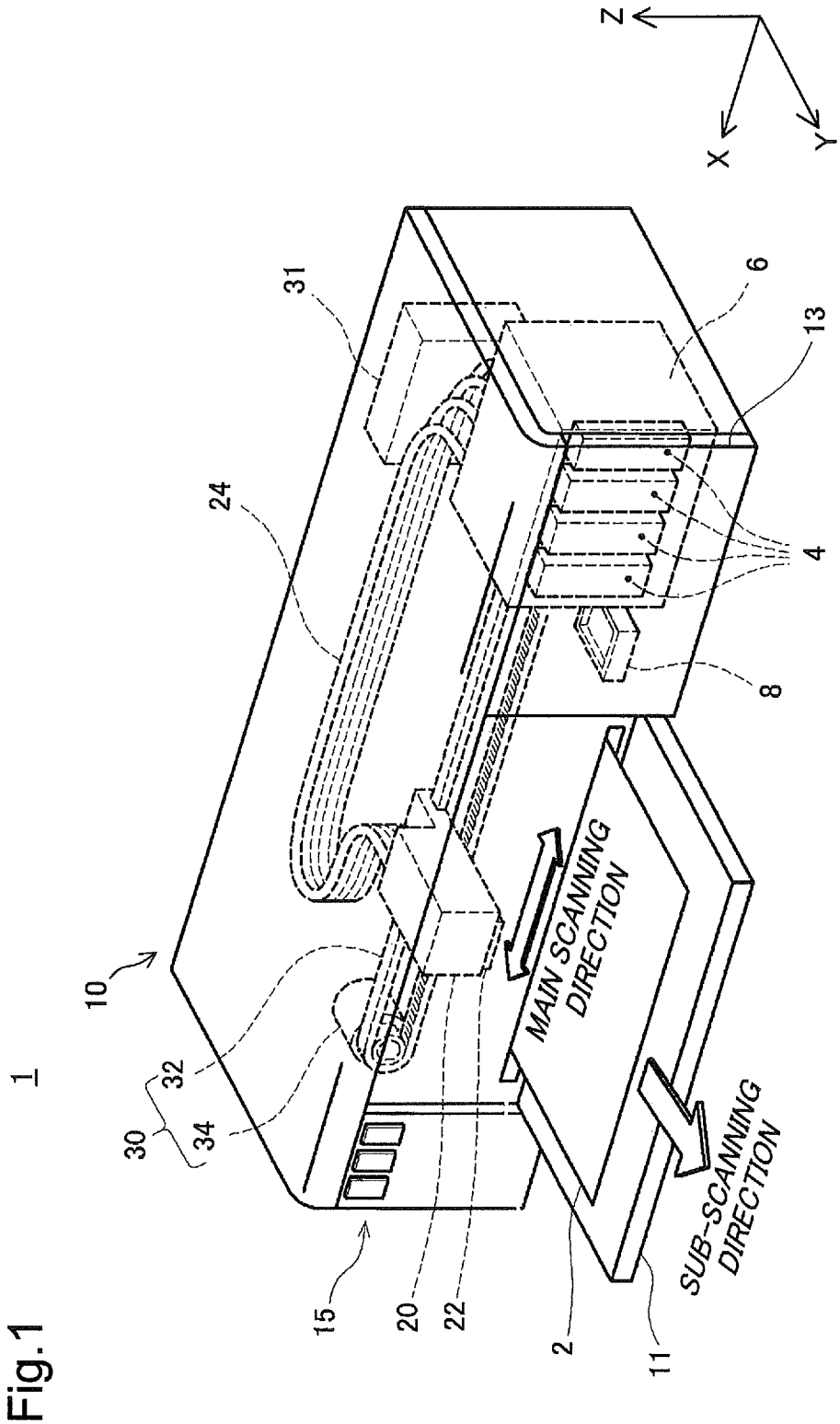
Primary Examiner — Stephen Meier
Assistant Examiner — Alexander D Shenderov
(74) *Attorney, Agent, or Firm* — Stroock & Stroock & Lavan LLP

(57) **ABSTRACT**

A cartridge comprises: a printing material container; a printing material supplier that supplies a printing material contained in the printing material container to a printing device; a first surface and a second surface that are opposed to each other; a third surface that intersects with the first surface and the second surface; a fourth surface that is opposed to the third surface; a cartridge-side engagement structure that is provided on the third surface at a position closer to the first surface than the second surface and is configured to be engaged with a device-side engagement structure of the printing device; and contact portions that are provided in an area where both an end of the first surface proximate to the fourth surface and an end of the fourth surface proximate to the first surface are located and are configured to be in contact with the printing device. A contact surface defined by the contact portions is inclined to the fourth surface.

12 Claims, 35 Drawing Sheets

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X
Y
1
10
31
6
13
24
4
8
MAIN SCANNING DIRECTION
SUB-SCANNING DIRECTION
32
30
34
15
20
22
2
11

Fig.1

Fig.2

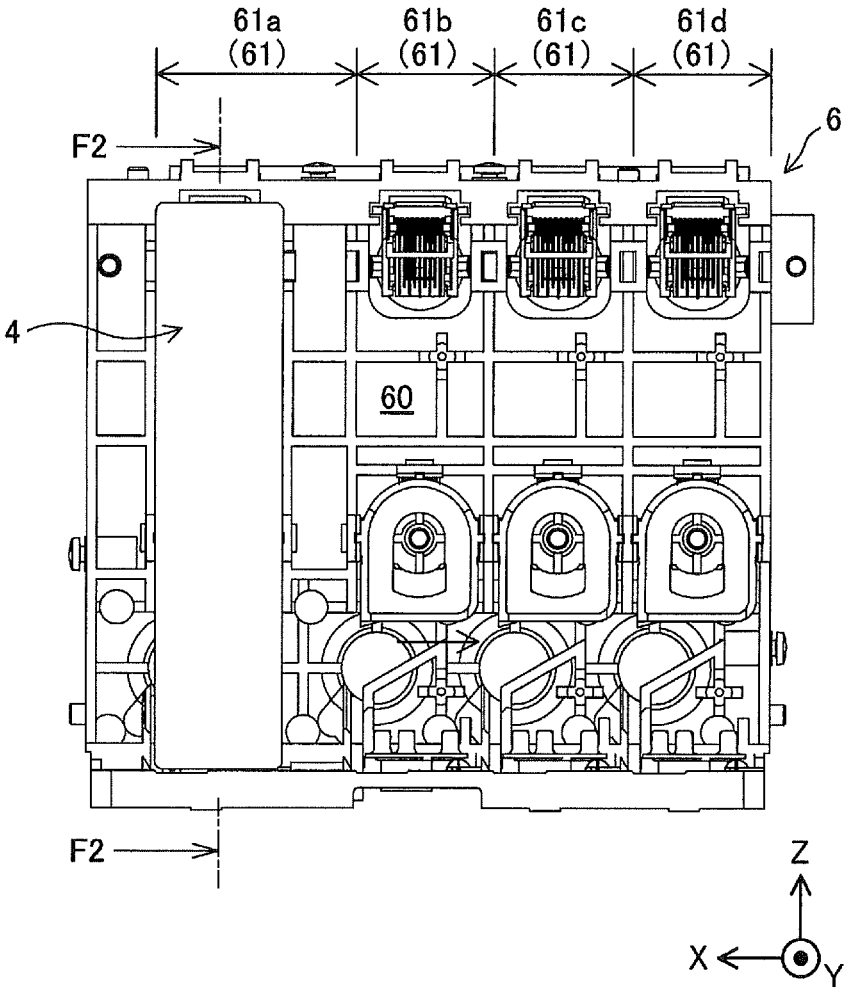
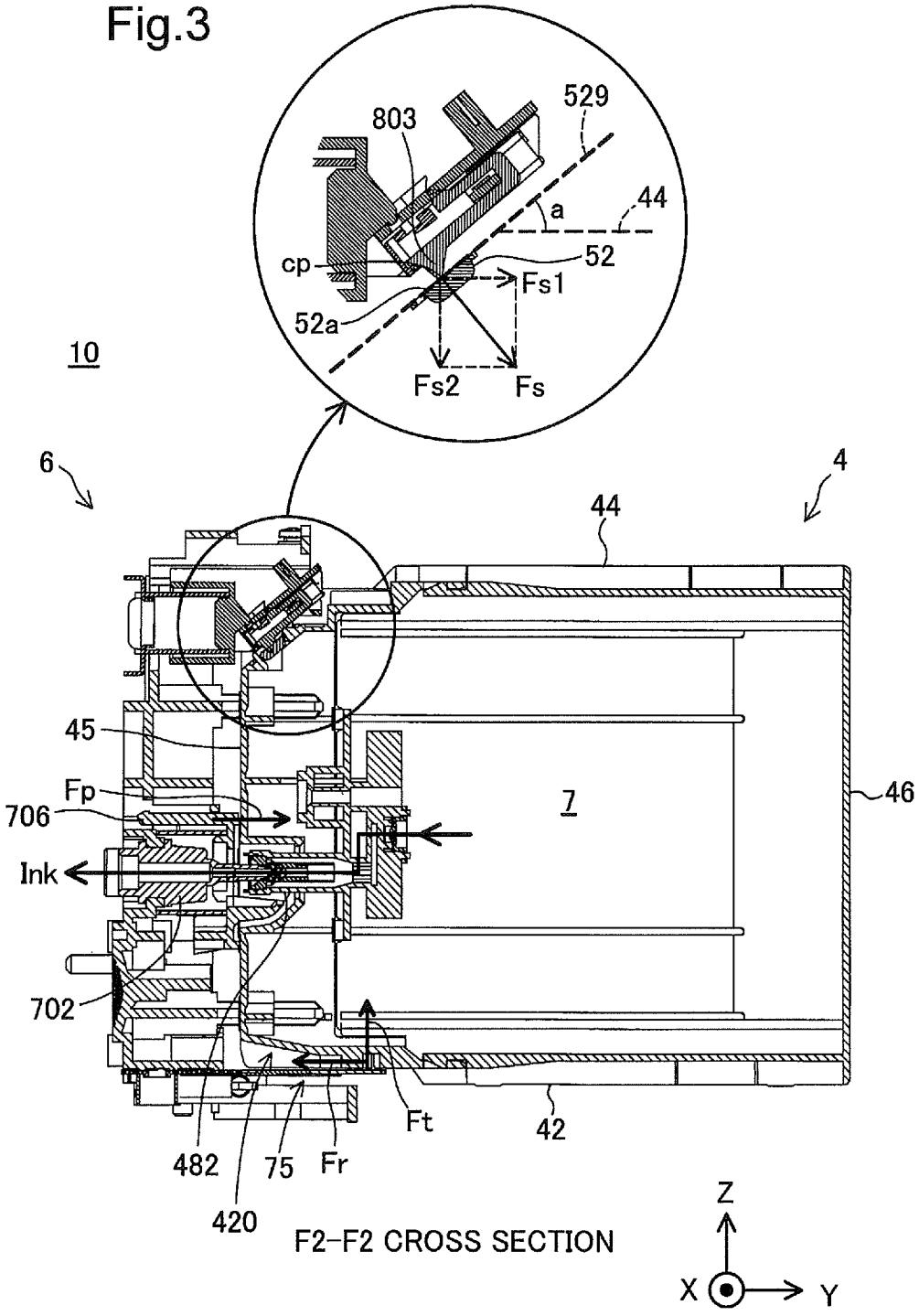


Fig.3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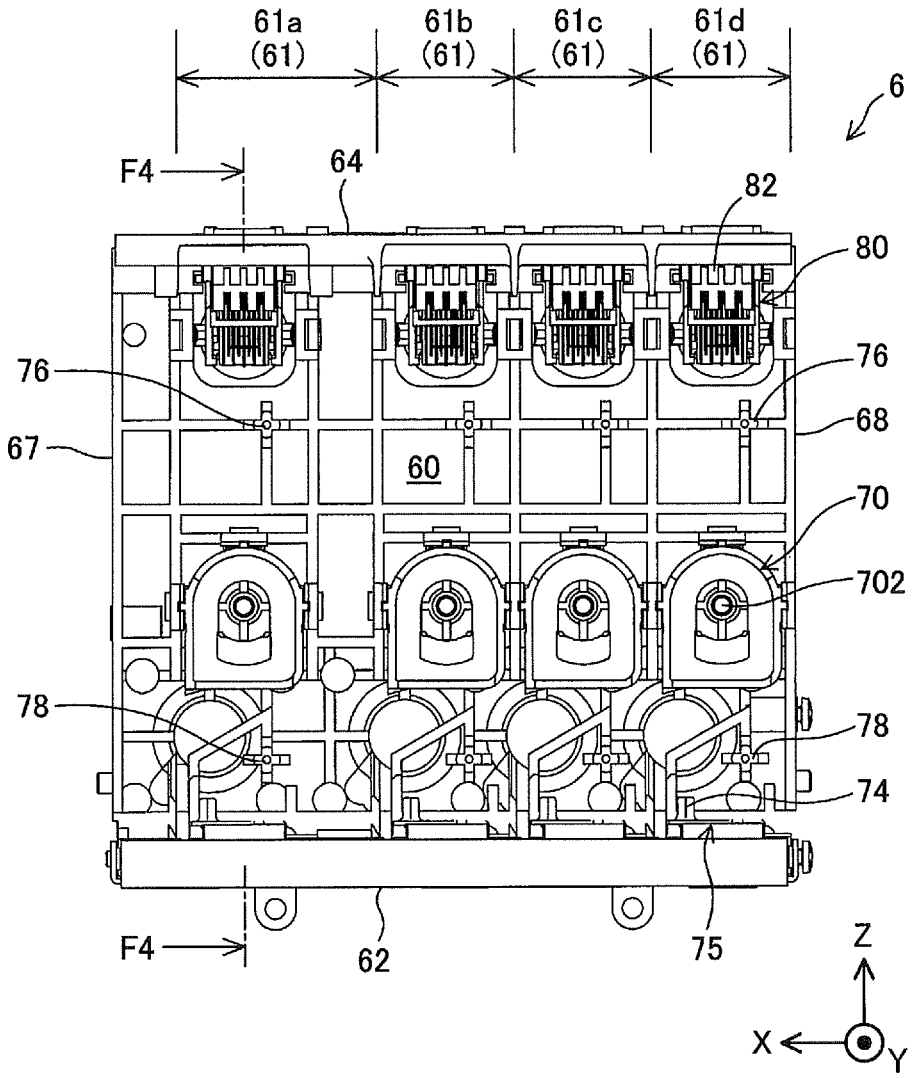
803
44
a
cp
52
Fs1
52a
Fs2
Fs
10
6
4
44
45
Fp
706
Ink
7
46
702
Ft
42
482
75
Fr
420
F2–F2 CROSS SECTION
Z
X
Y

Fig.4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(61)
61b
(61)
61c
(61)
61d
(61)
6
F4
64
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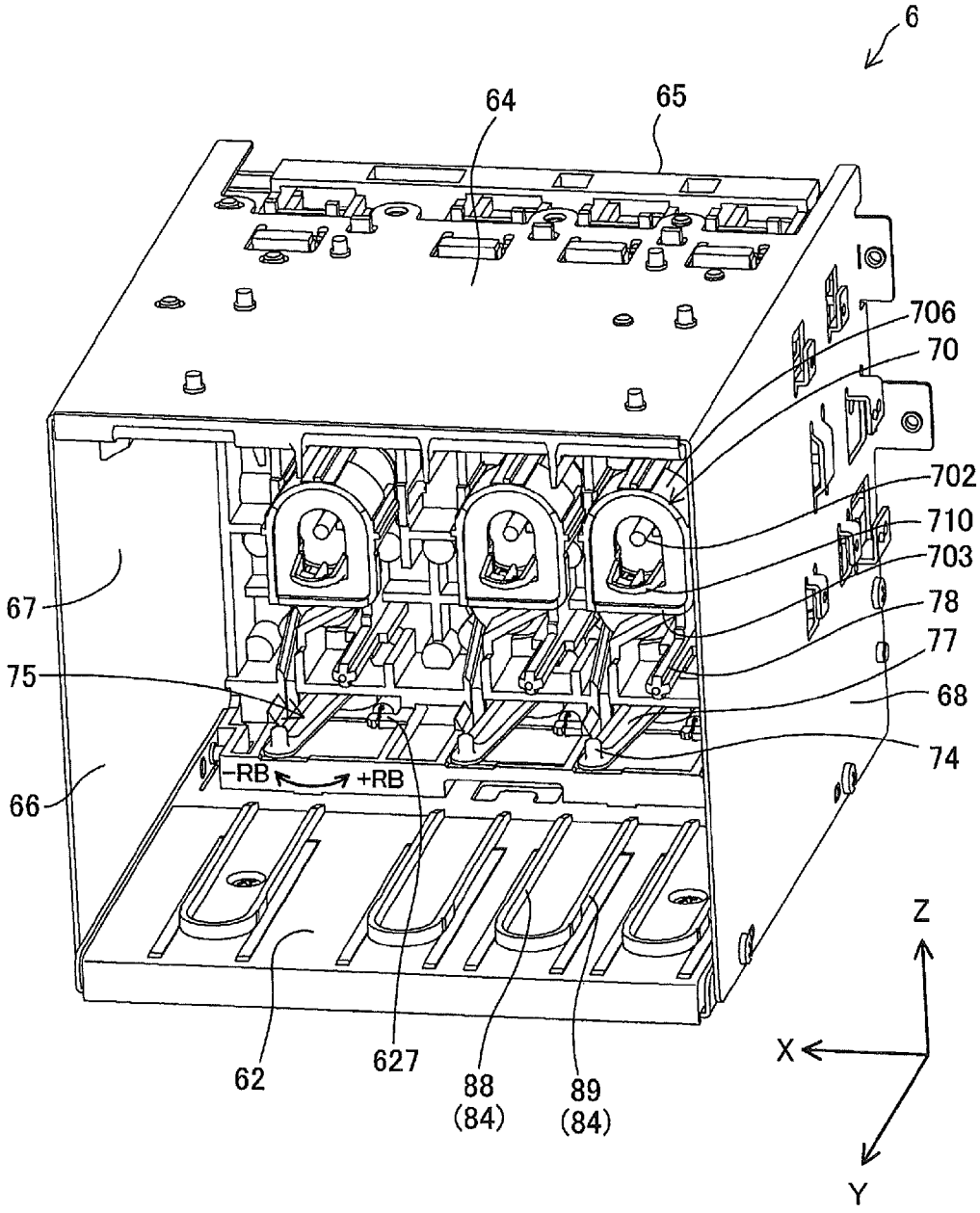
68
67
60
70
702
78
78
74
F4
62
75
Z
X
Y

Fig.5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64
65
706
70
702
710
703
78
77
68
74
67
75
66
-RB
+RB
62
627
88
(84)
89
(84)
Z
X
Y

Fig.6

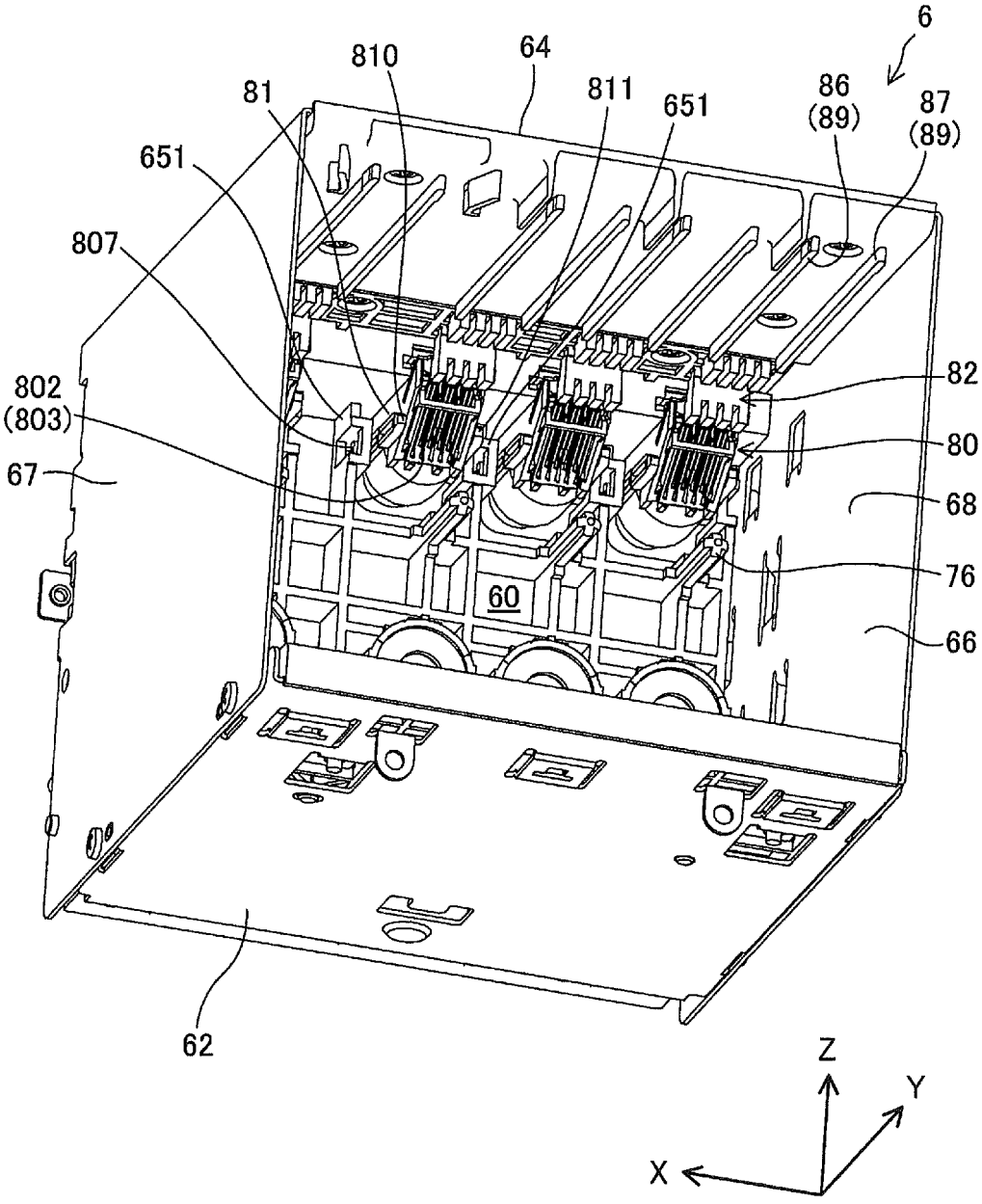

6
810
64
81
811
651
86
(89)
87
(89)
651
807
82
802
(803)
80
67
68
76
60
66
62
Z
Y
X

Fig.7

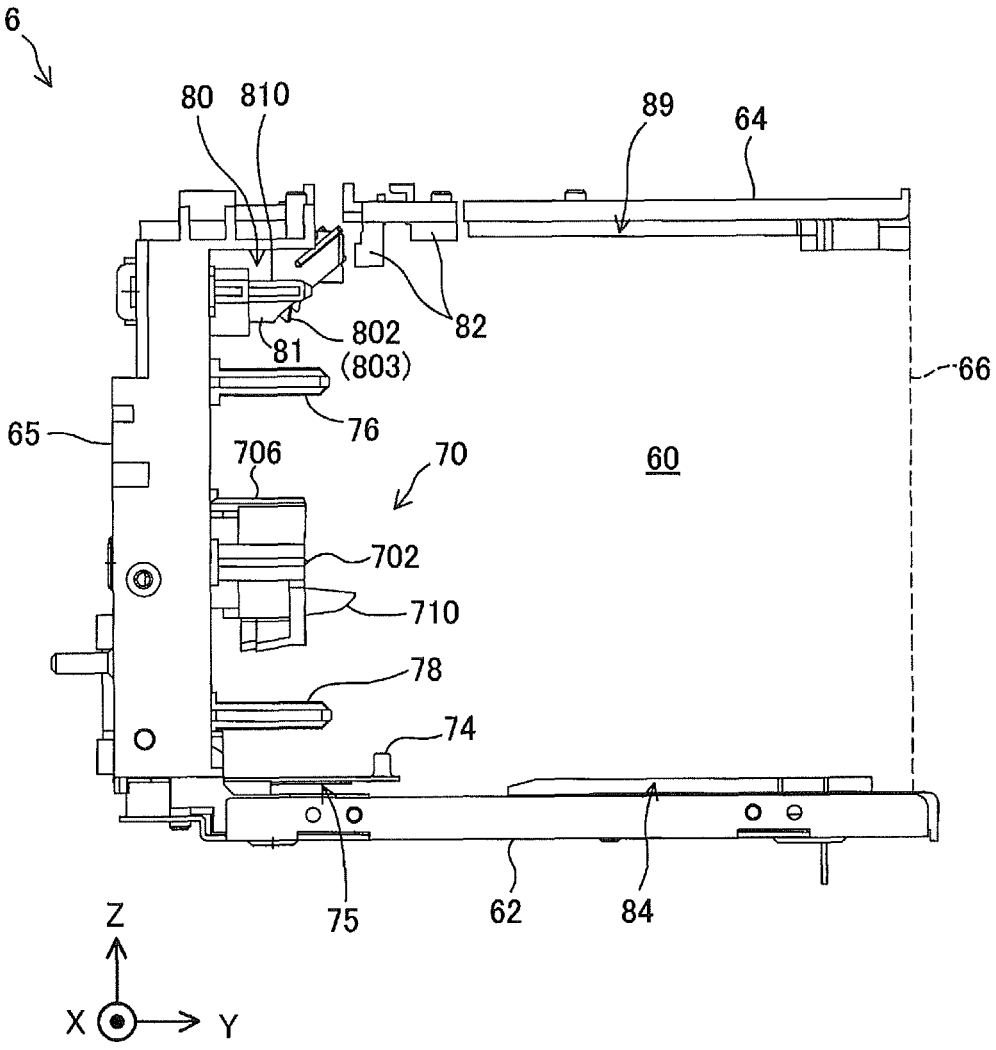
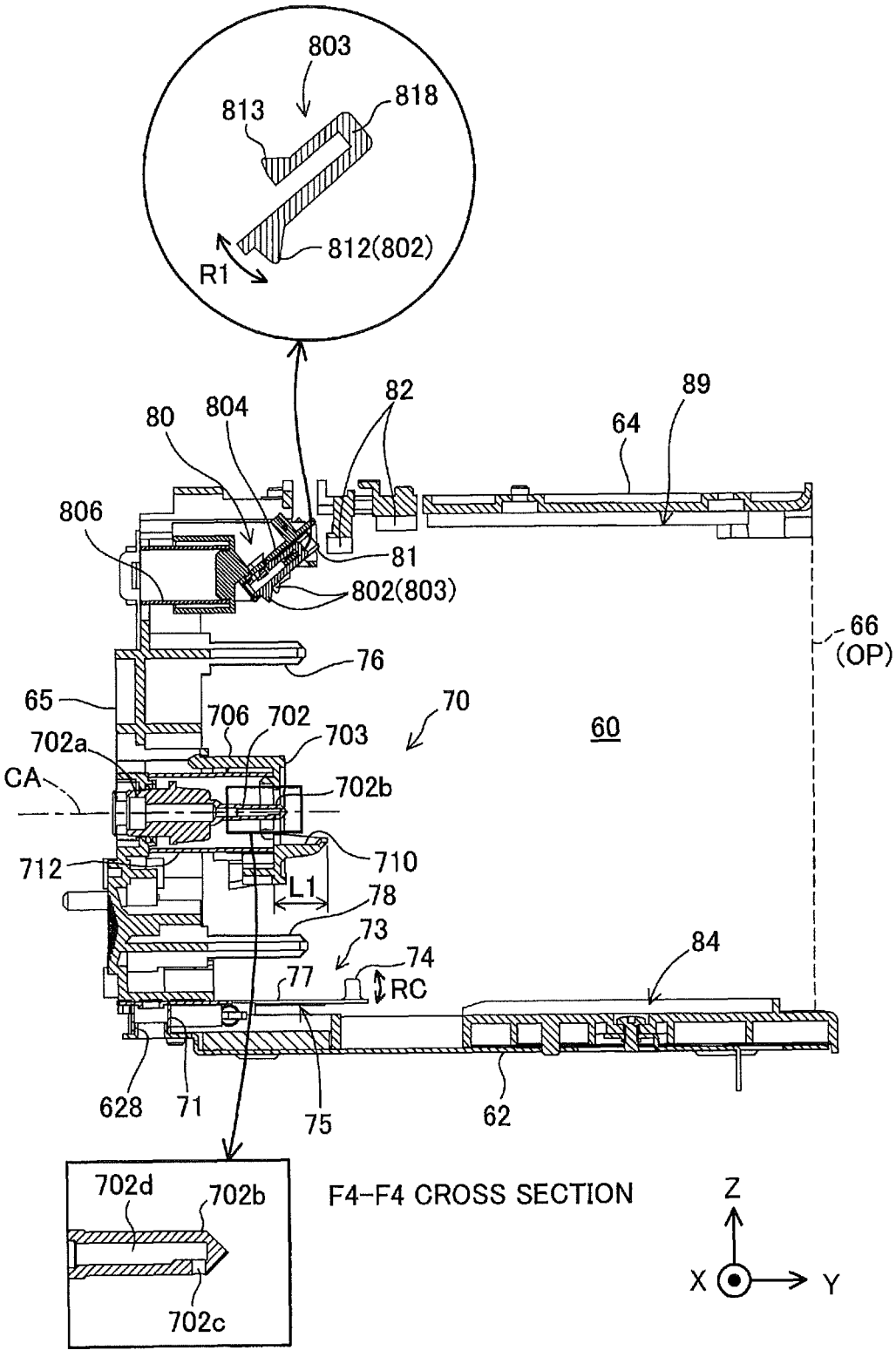

6
80
810
89
64
82
802
(803)
81
66
65
76
706
70
60
702
710
78
74
75
62
84
Z
X
Y

Fig.8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813
818
812(802)
R1
82
89
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804
64
806
81
802(803)
66
(OP)
76
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706
702
70
703
60
702a
CA
702b
712
710
L1
78
73
74
84
77
RC
628
71
75
62
702d
702b
702c
F4-F4 CROSS SECTION
Z
X
Y

Fig.9

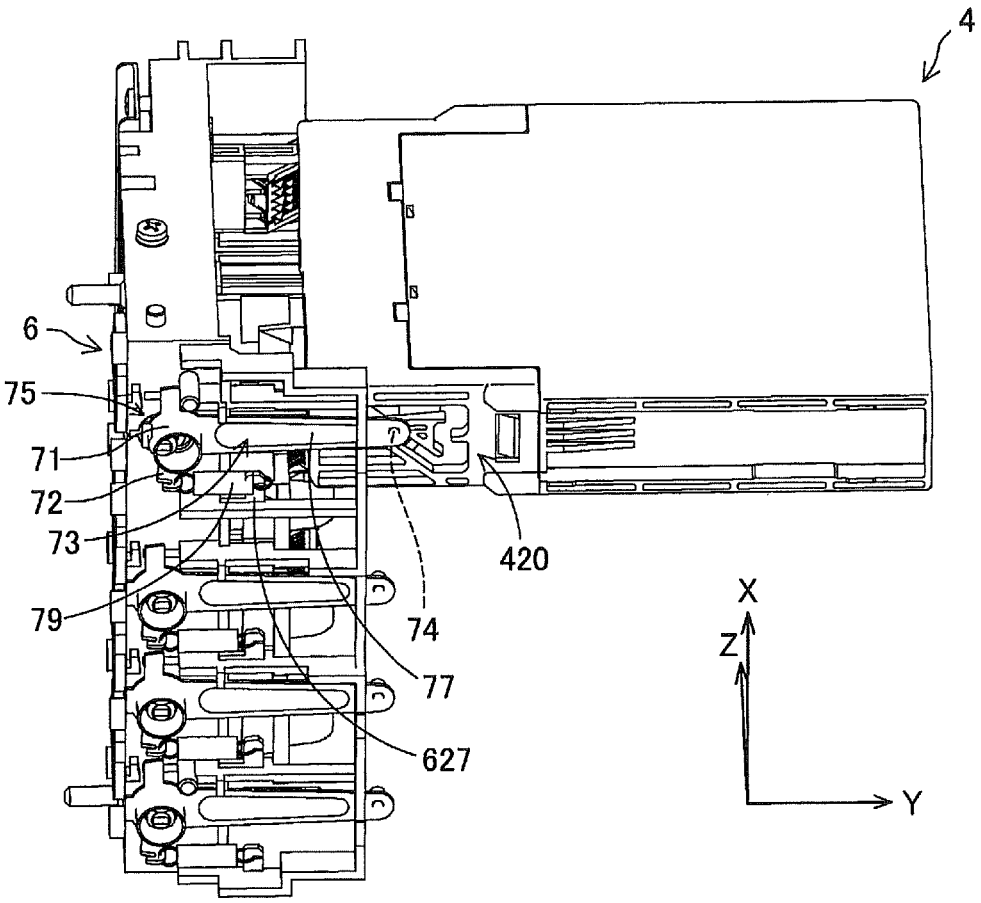


Fig.10

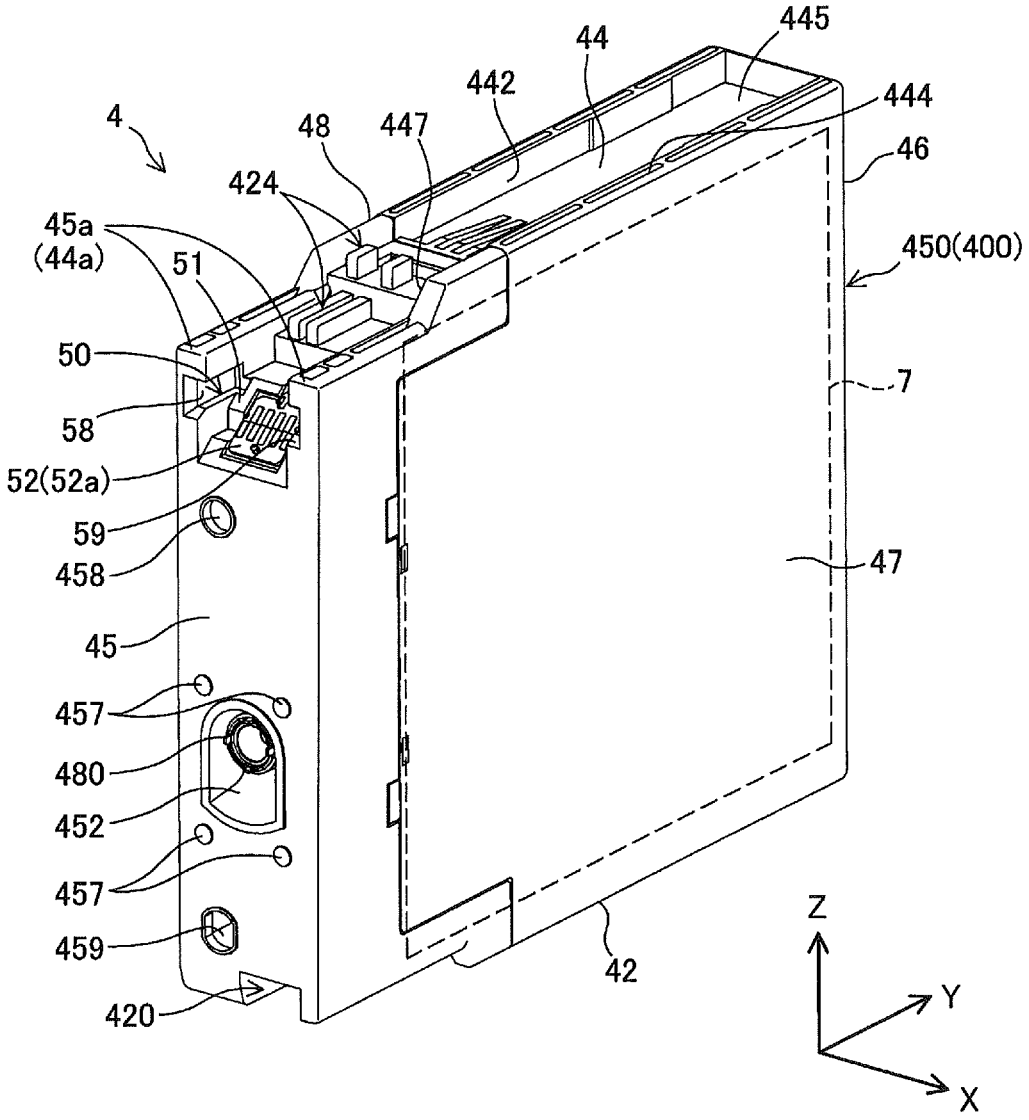
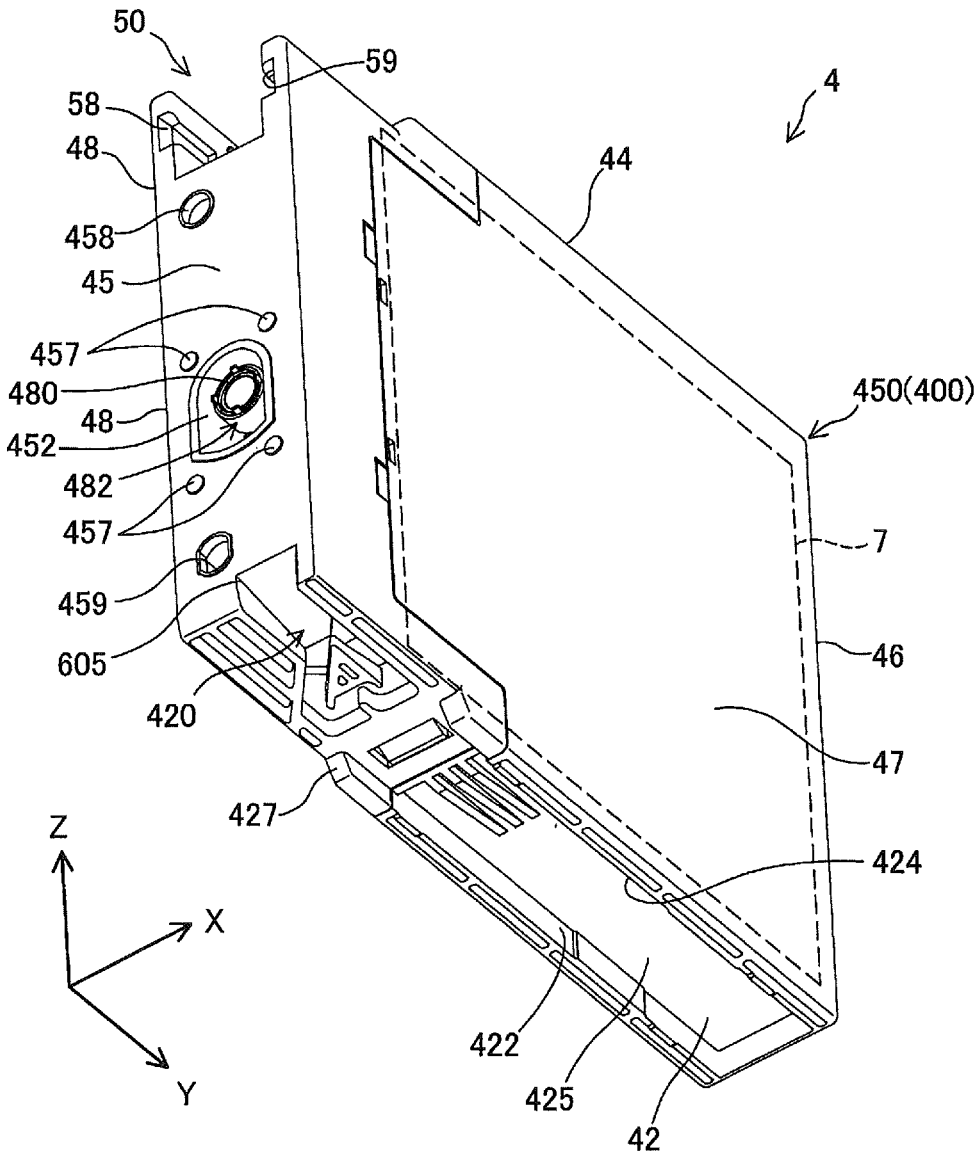

445
44
442
444
4
48
447
46
424
45a
(44a)
51
450(400)
50
7
58
52(52a)
59
458
47
45
457
480
452
457
459
420
42
Z
Y
X

Fig.11


50
59
4
58
48
44
458
45
457
480
450(400)
48
452
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457
7
459
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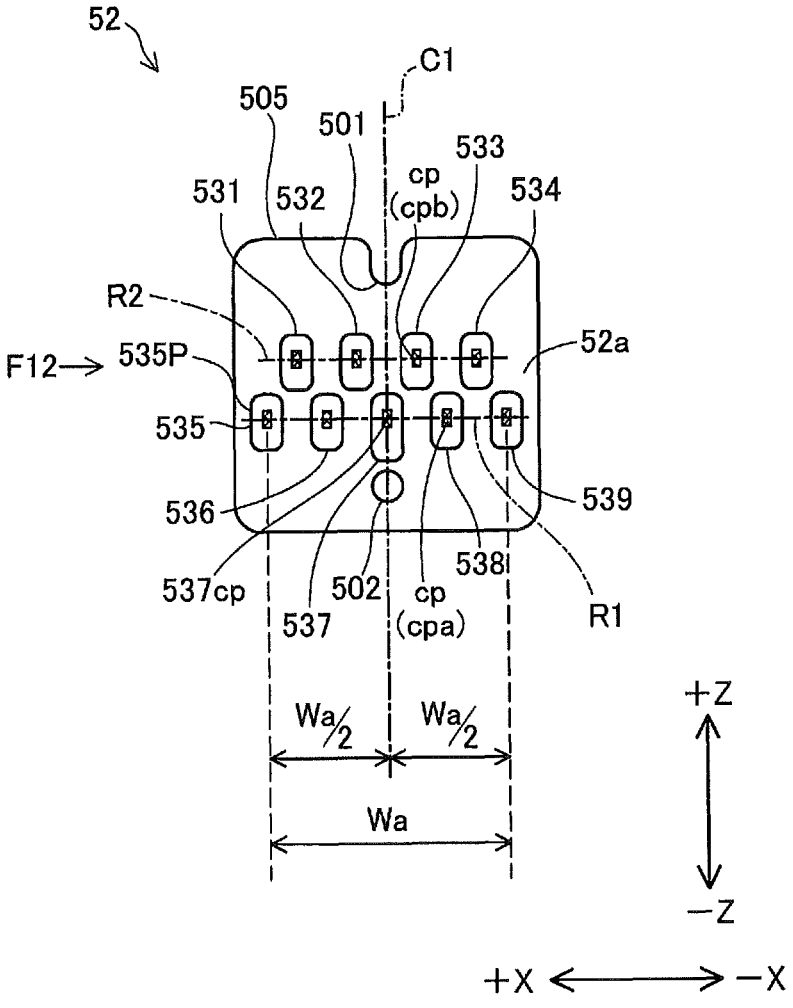
605
420
47
427
424
Z
X
Y
422
425
42

Fig.12


52
C1
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501
533
531
532
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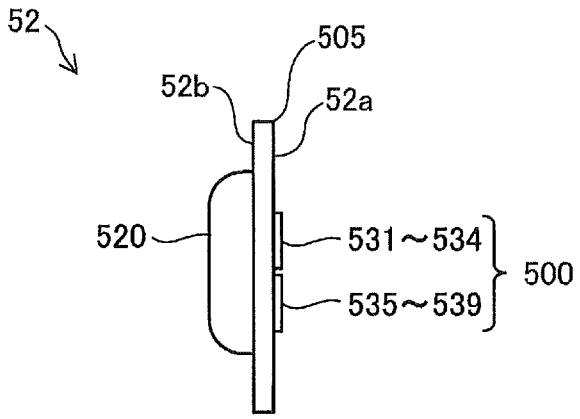
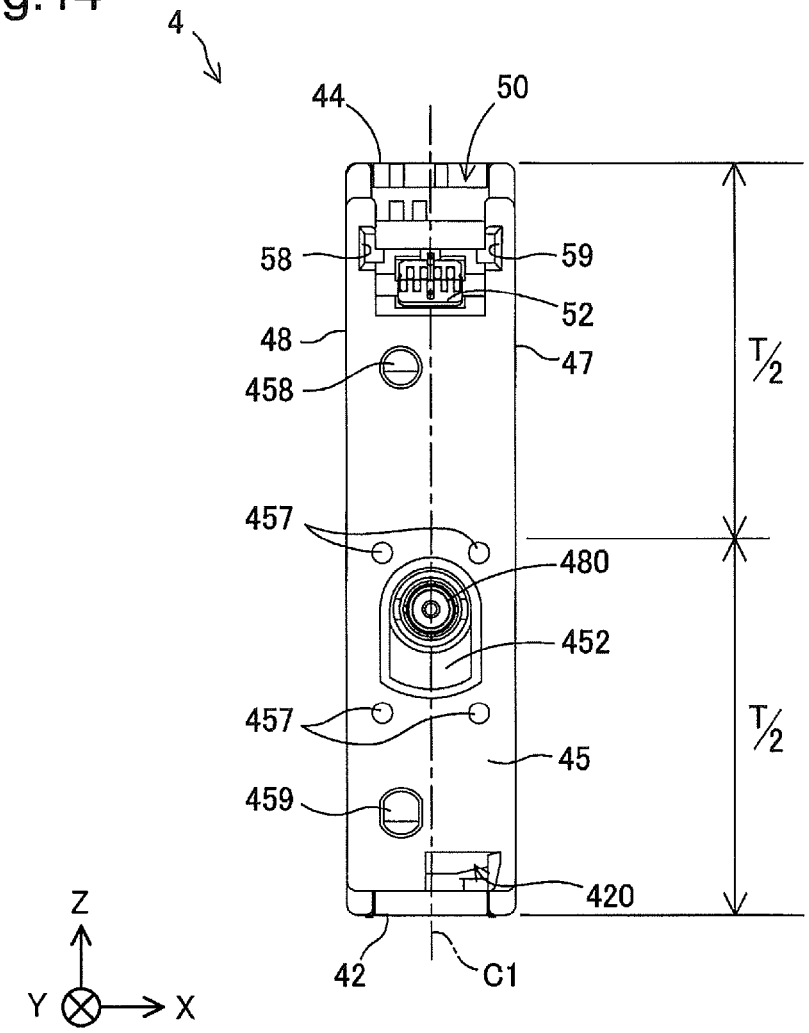
534
R2
F12
535P
52a
535
536
539
537cp
537
502
cp
(cpa)
538
R1
Wa/2
Wa/2
Wa
+Z
−Z
+X
−X

Fig.13



VIEW FROM F12

Fig.14



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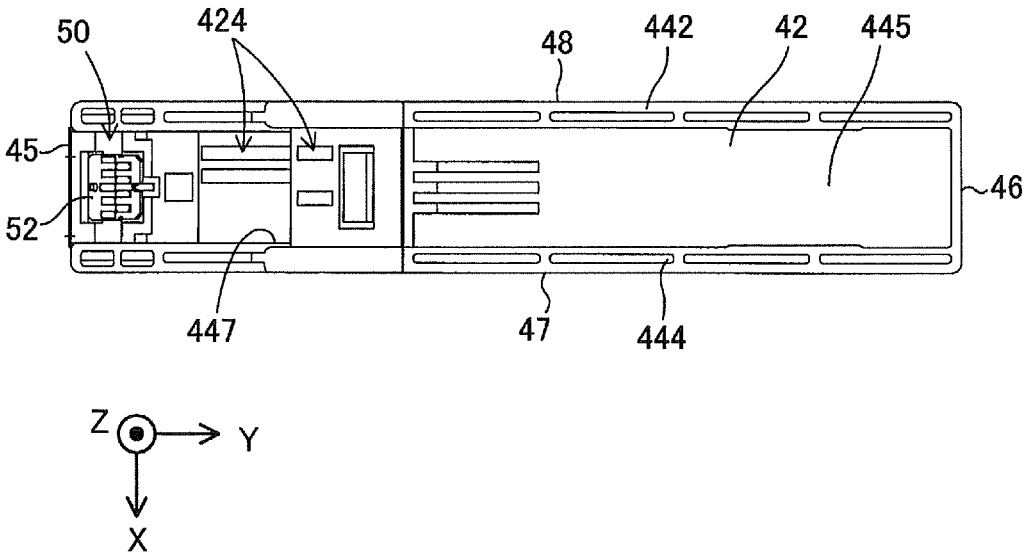

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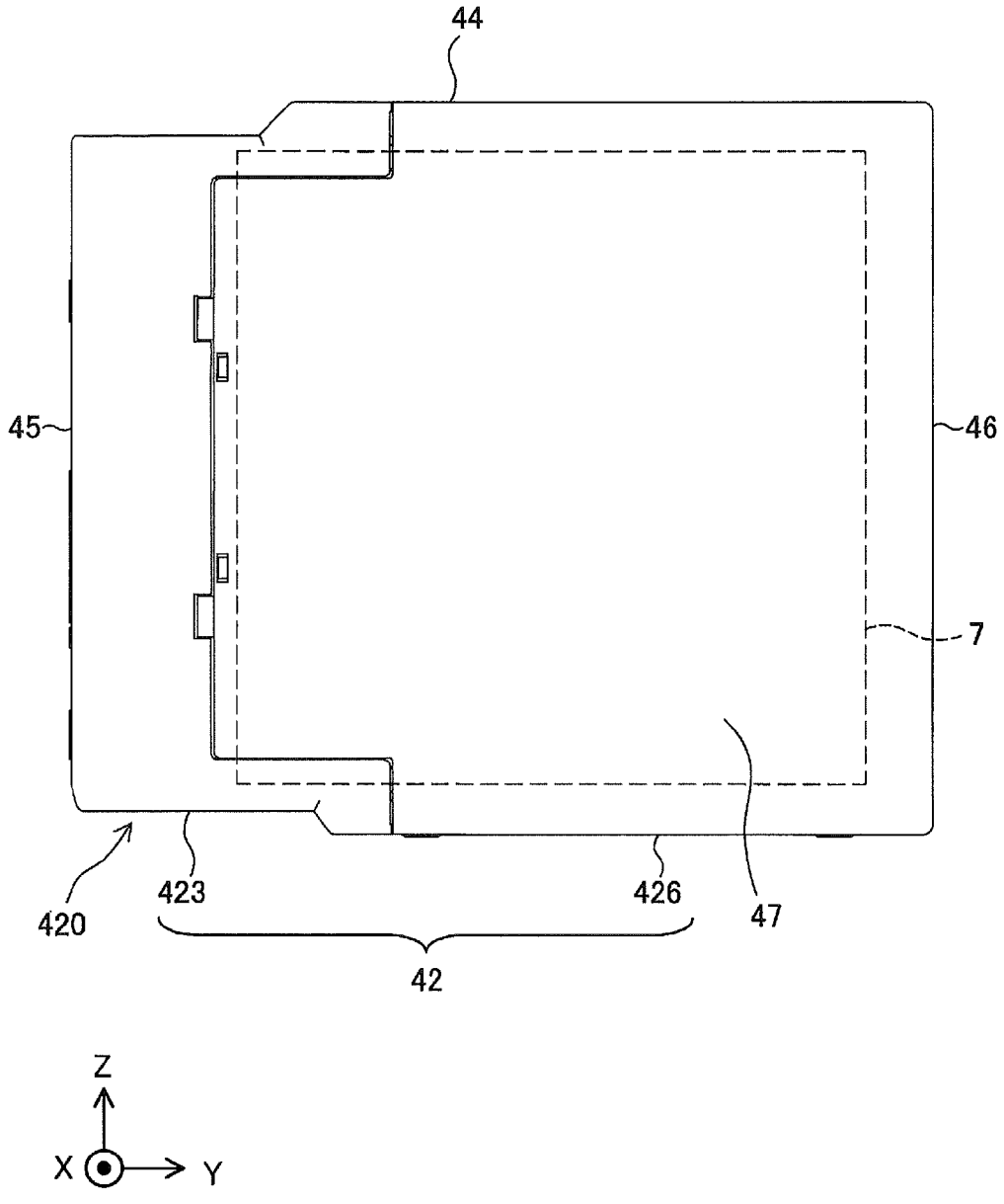

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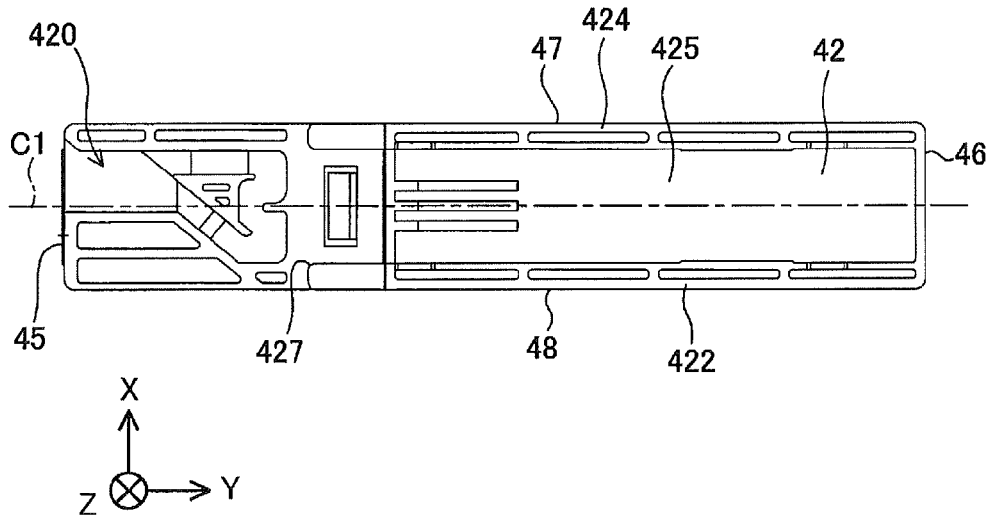

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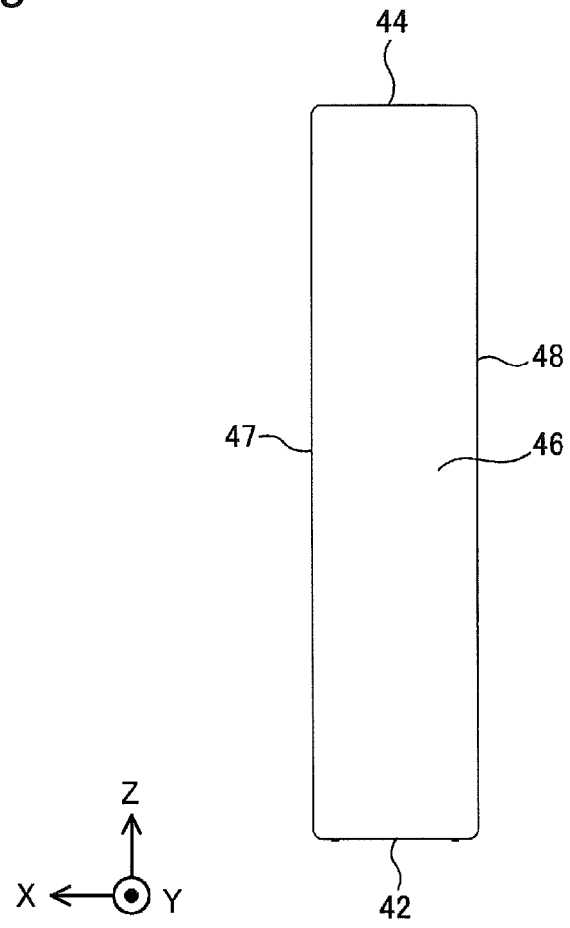

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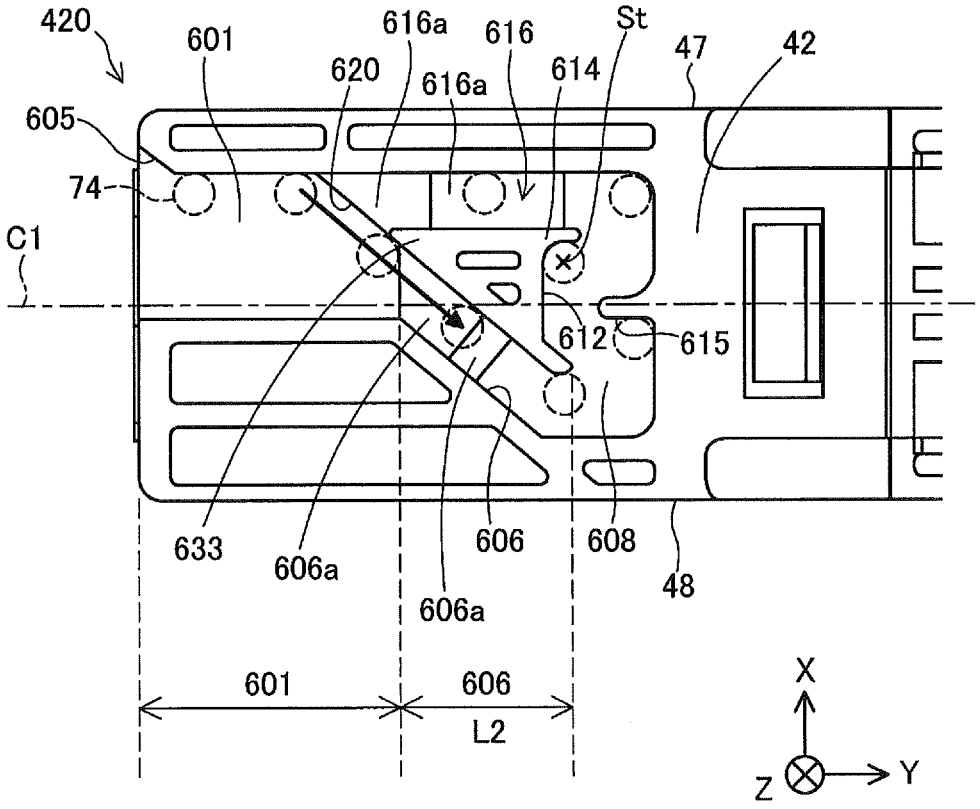
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616a
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C1
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606a
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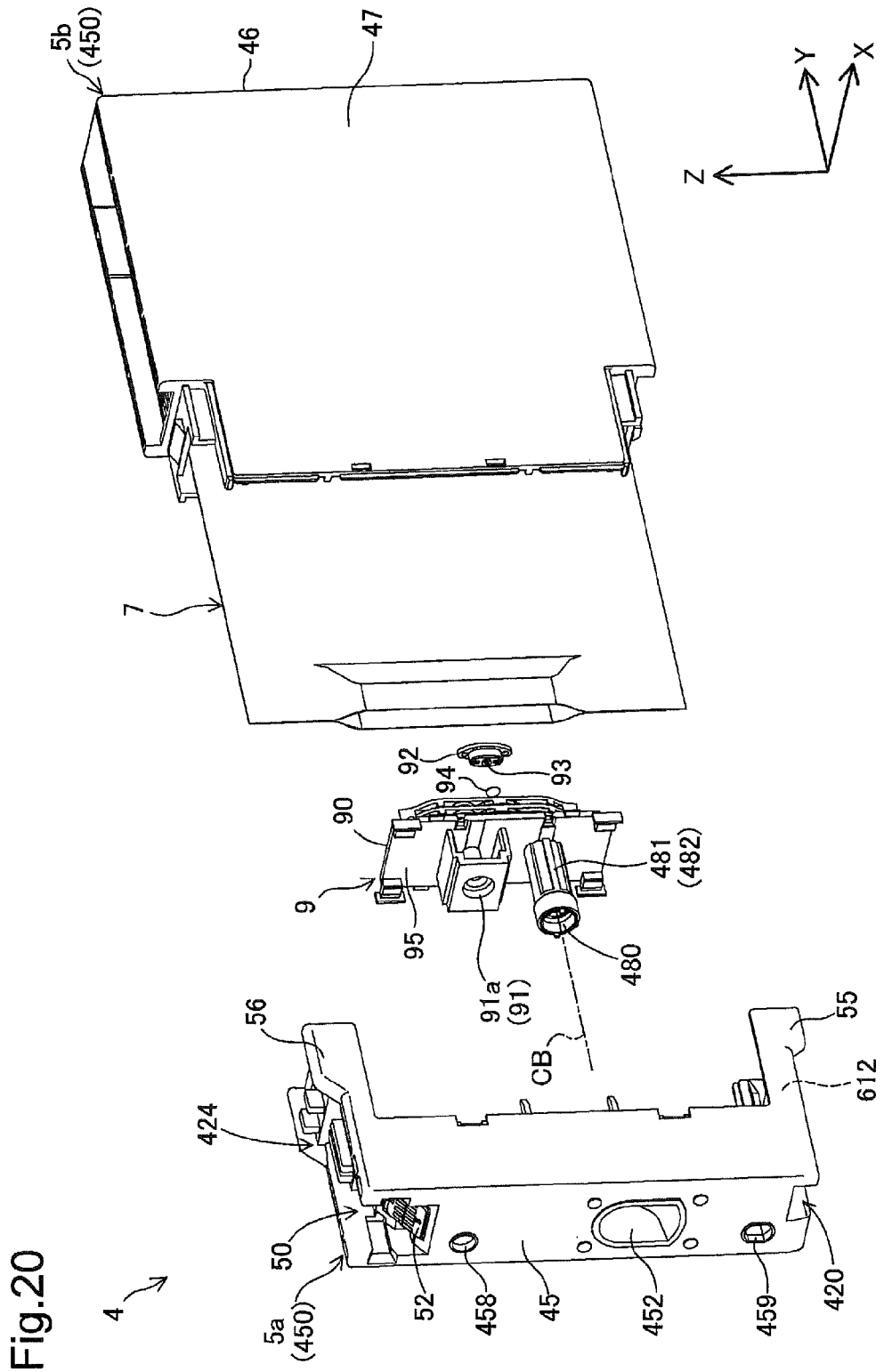
606
L2
X
Z
Y


5b
(450)
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Y
X
Z
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(482)
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91a
(91)
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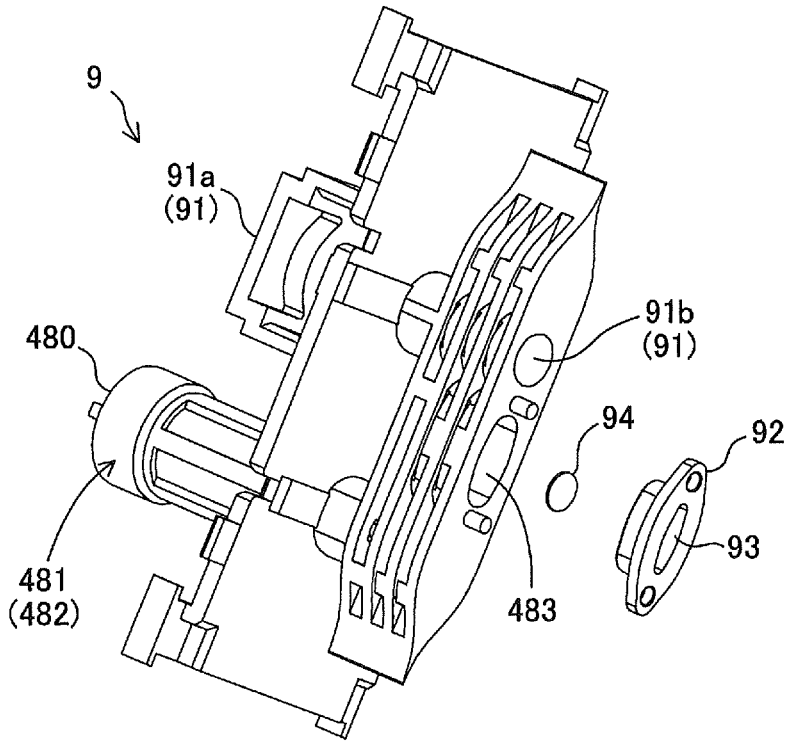
(450)
52
458
45
452
459
420
4

Fig.20

Fig.21



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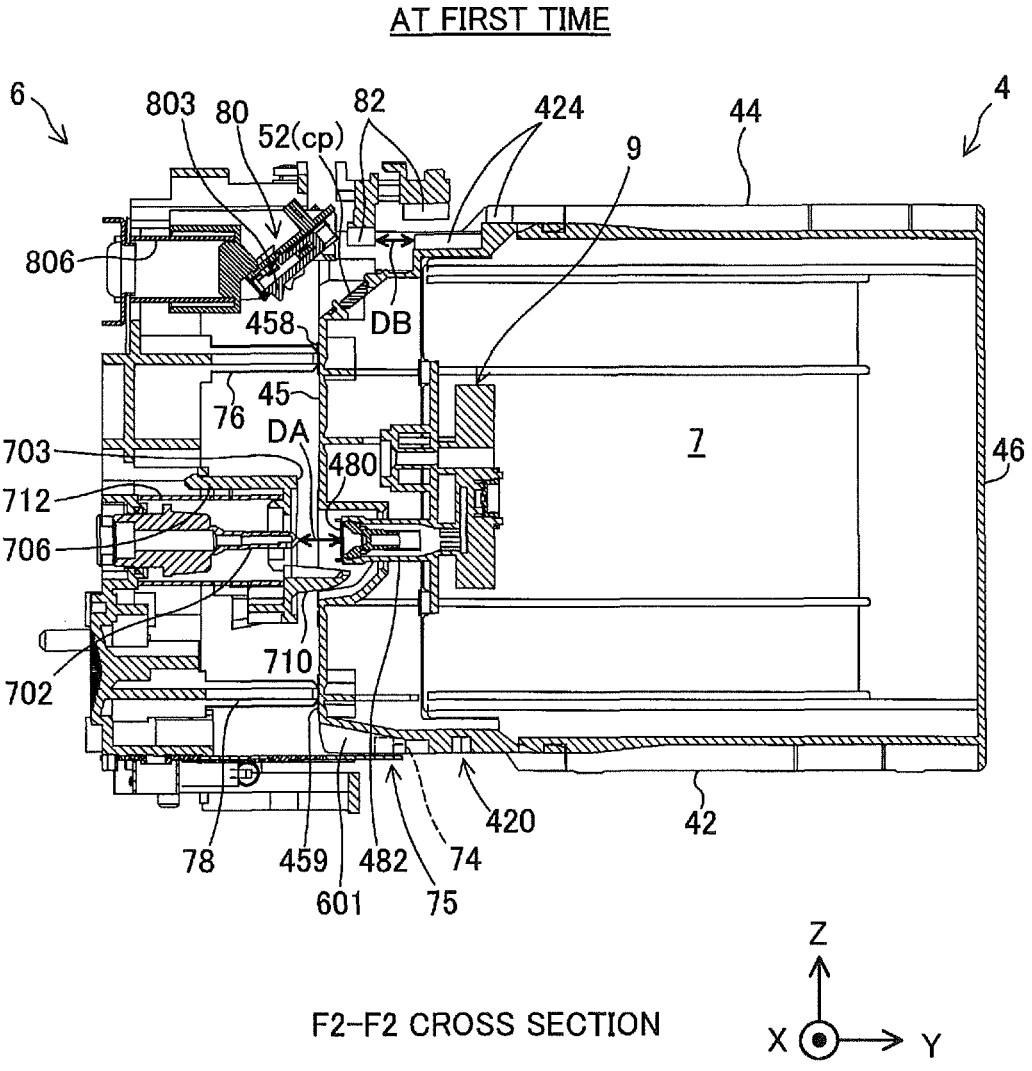
AT FIRST TIME
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803
80
52(cp)
82
424
44
4
9
806
458
DB
45
76
DA
703
480
7
46
712
706
710
702
78
459
482
74
601
75
420
42
F2-F2 CROSS SECTION
Z
X
Y

Fig.23

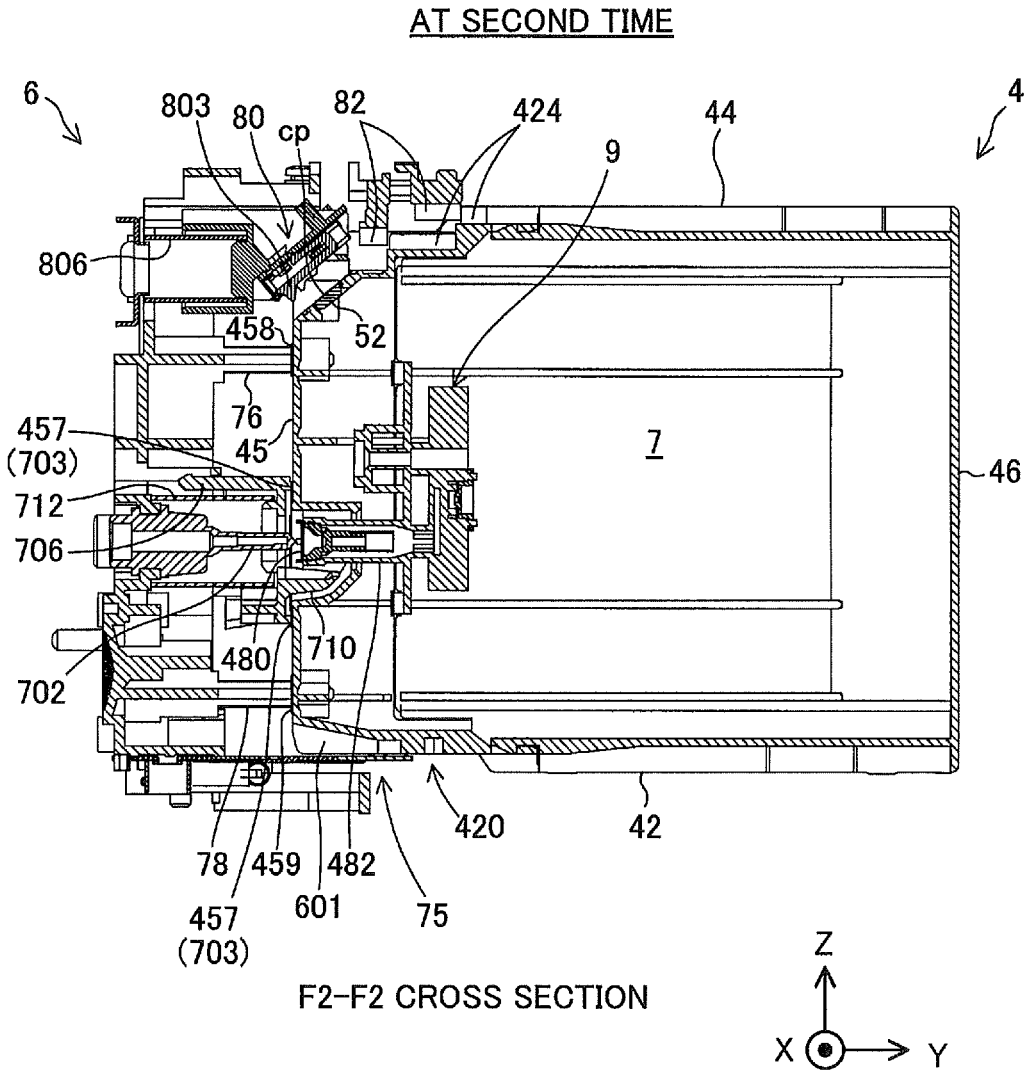

AT SECOND TIME
6
803
80
cp
82
424
44
4
9
806
458
52
76
45
457
(703)
712
706
7
46
480
710
702
420
42
78
459
482
601
75
457
(703)
F2-F2 CROSS SECTION
Z
X
Y

Fig.24

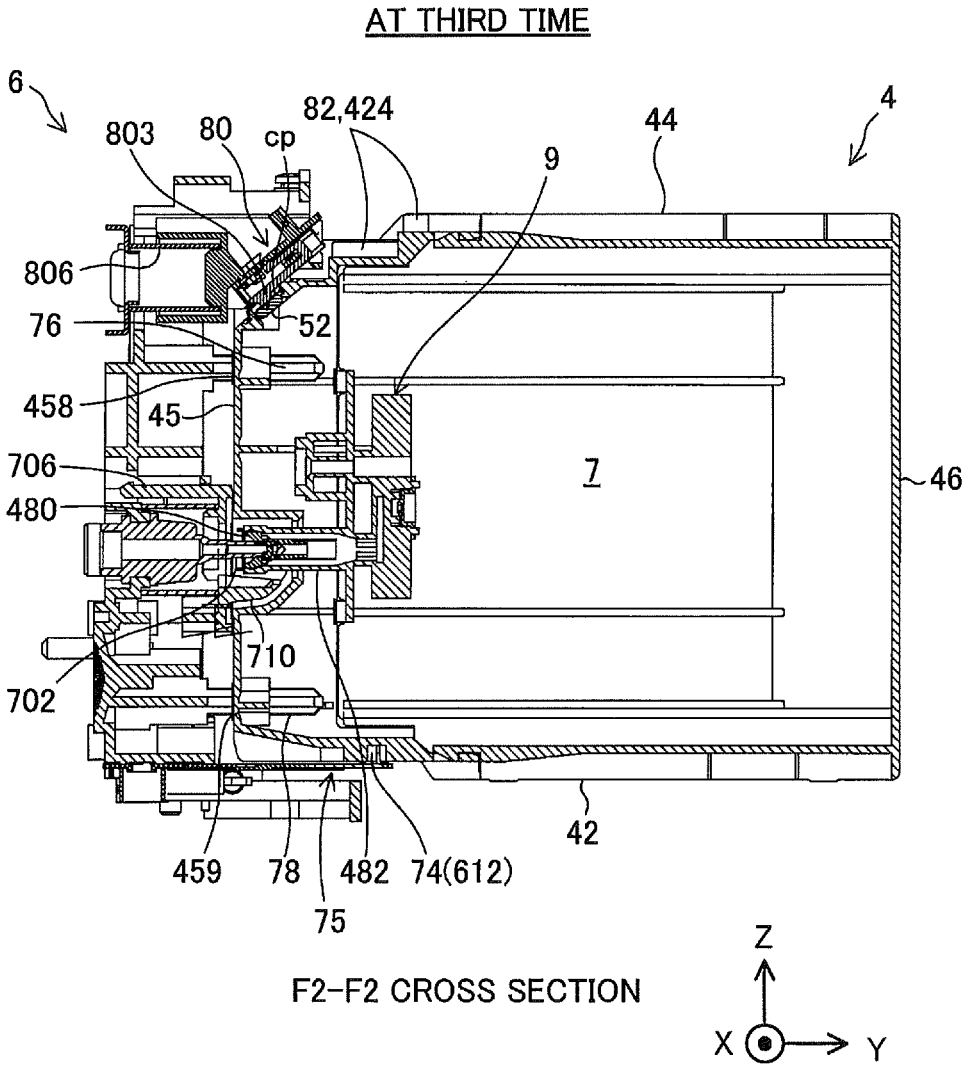
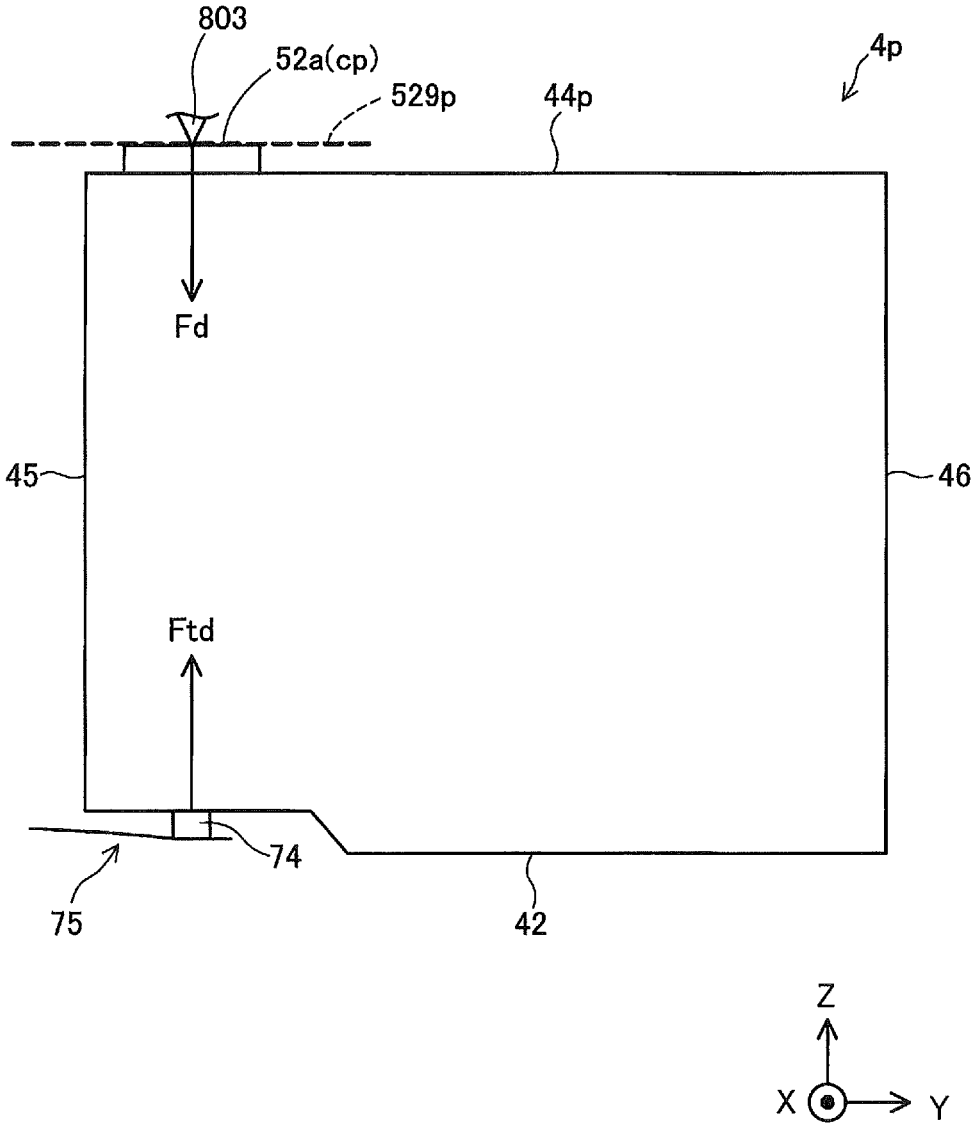

AT THIRD TIME
6
803
80
cp
82,424
9
44
4
806
76
52
458
45
706
480
7
46
710
702
459
78
482
74(612)
75
42
F2-F2 CROSS SECTION
Z
X
Y

Fig.25



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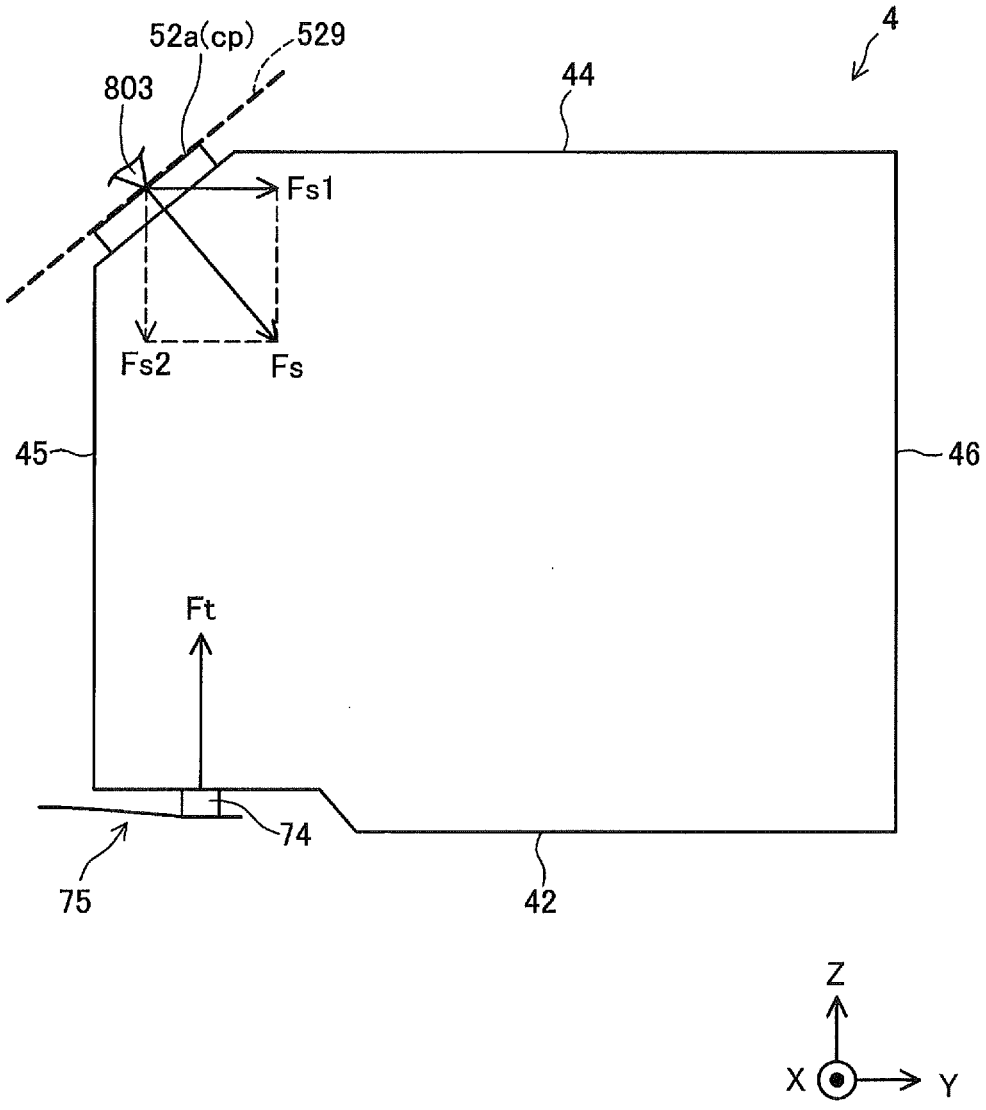

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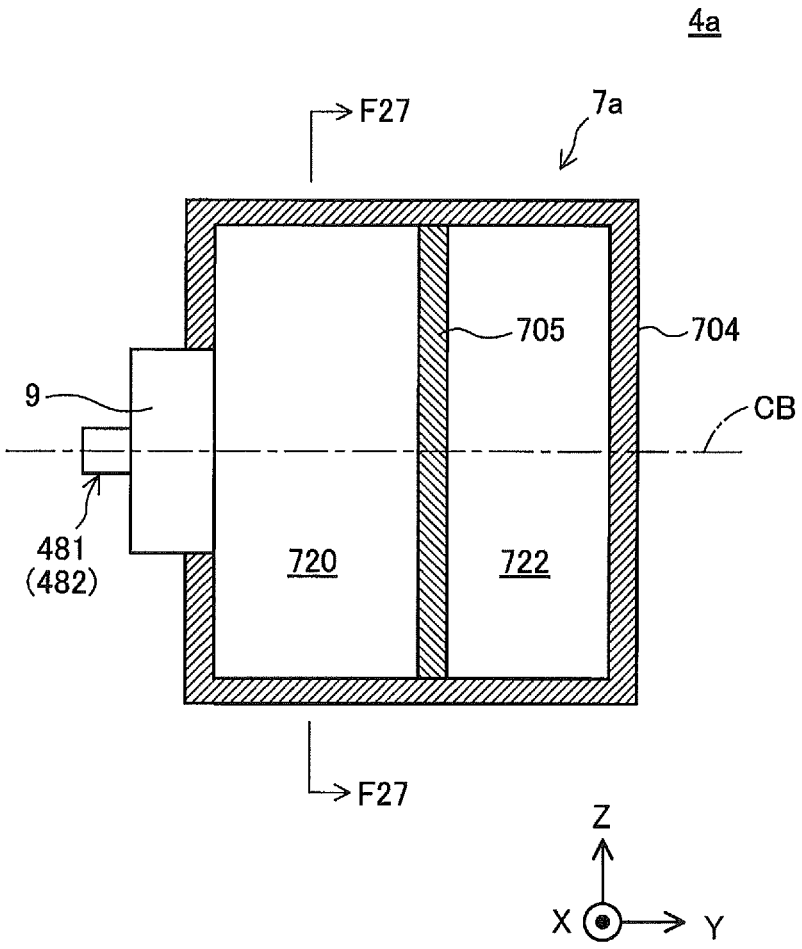

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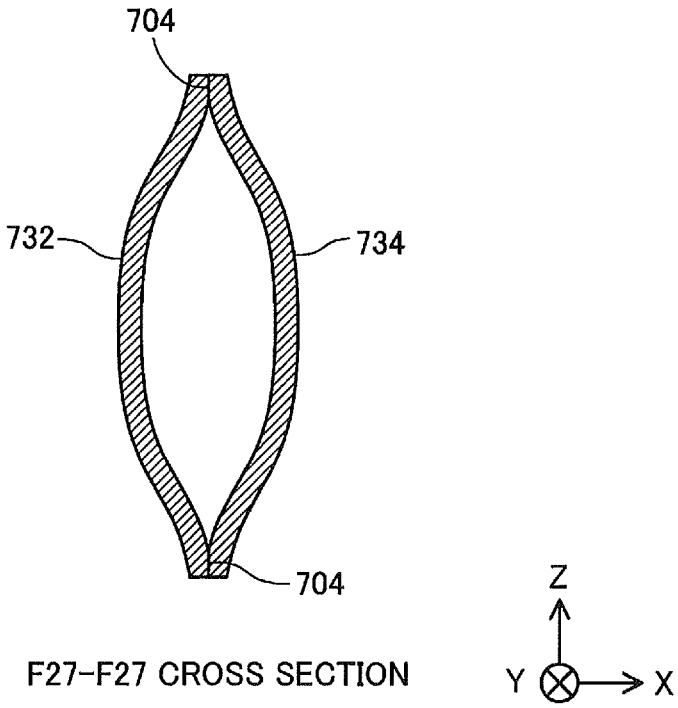


F27-F27 CROSS SECTION

Fig.29

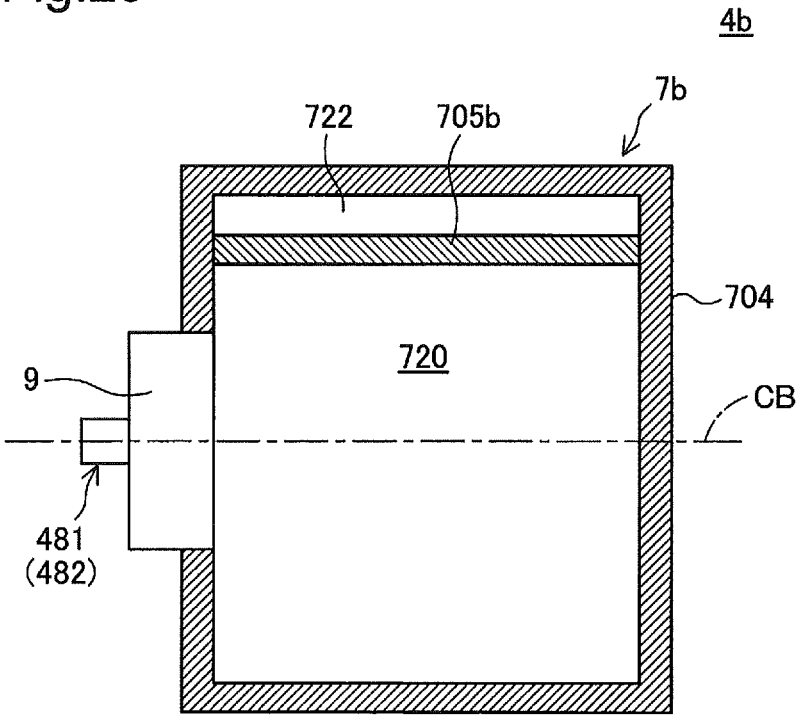
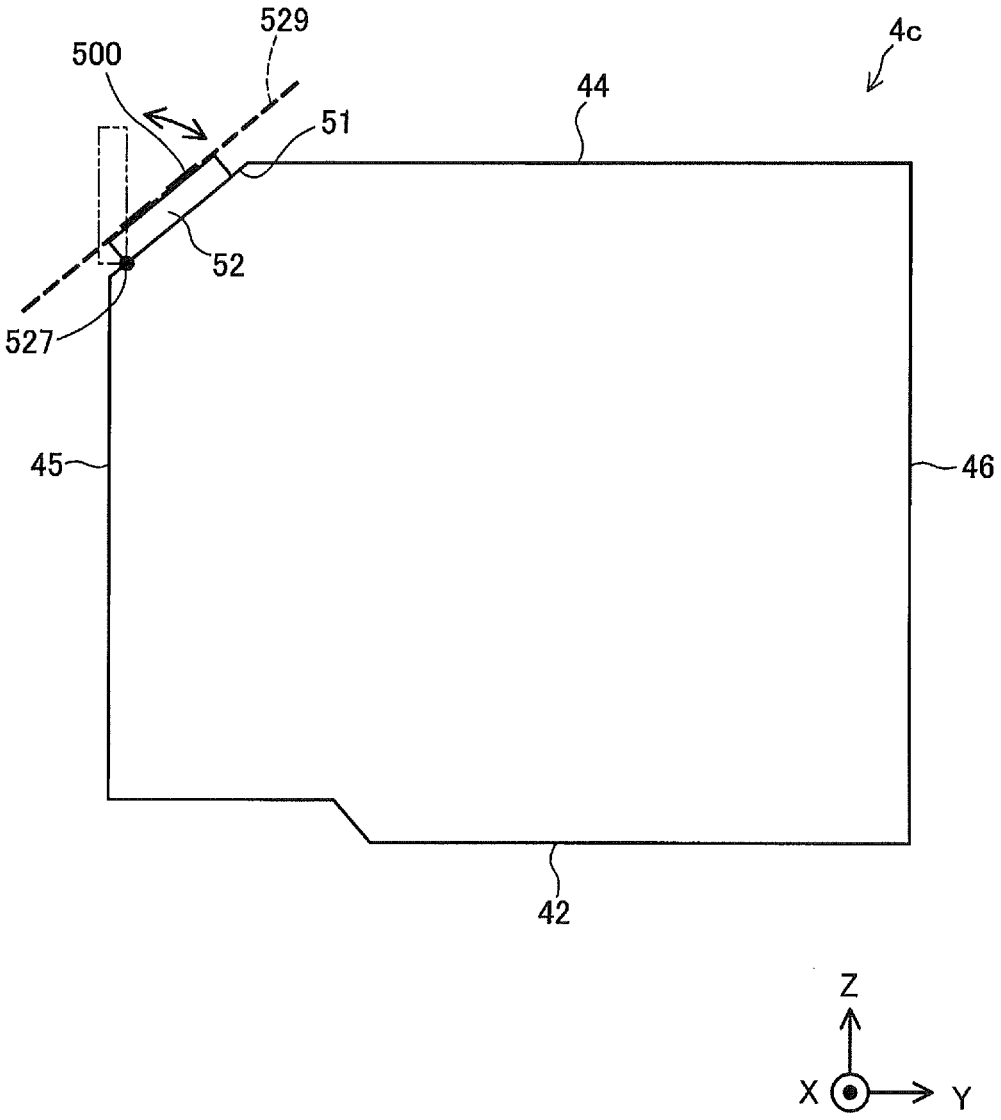


Fig.30



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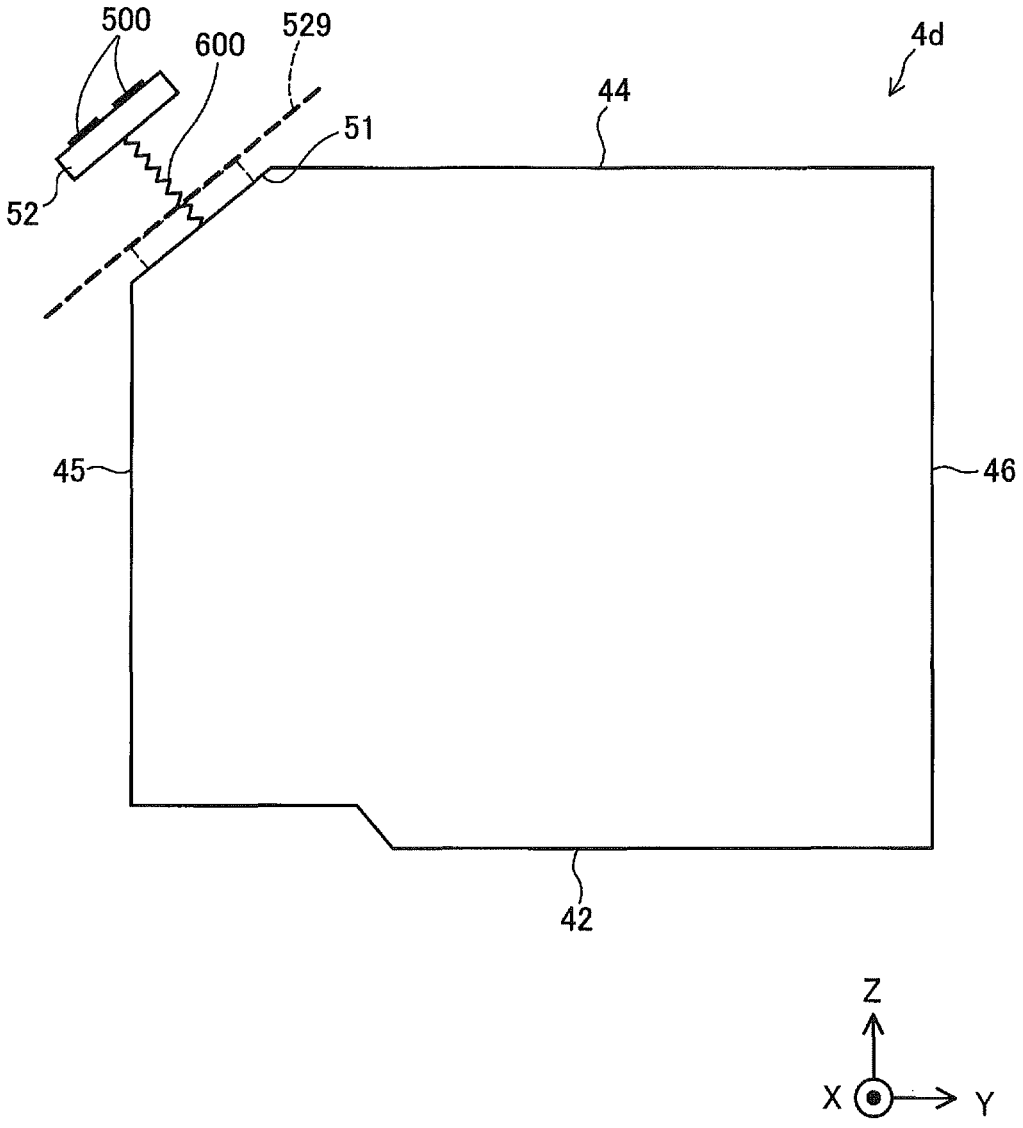


Fig.31B

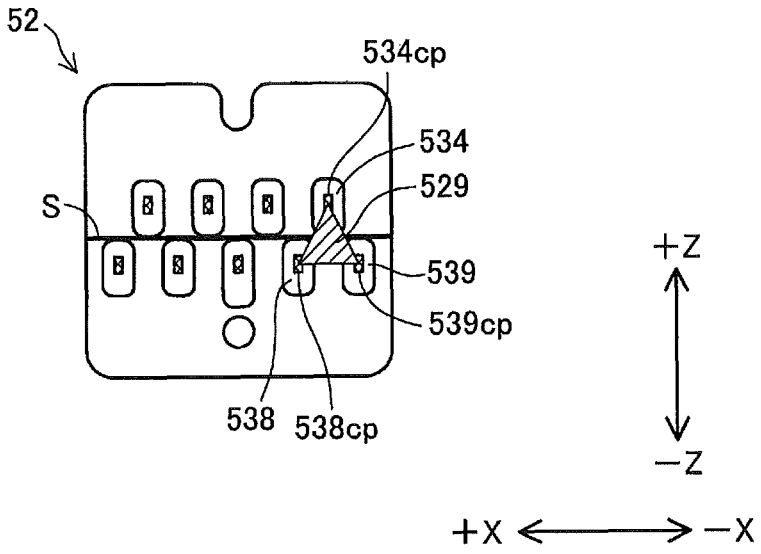
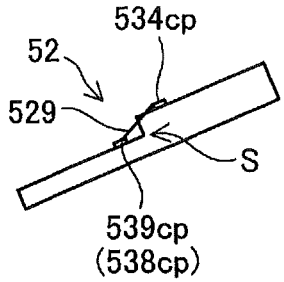


Fig.31C



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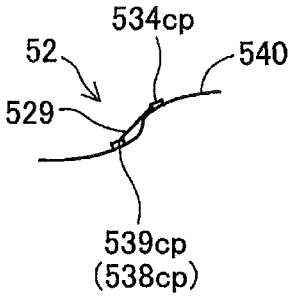


Fig.32

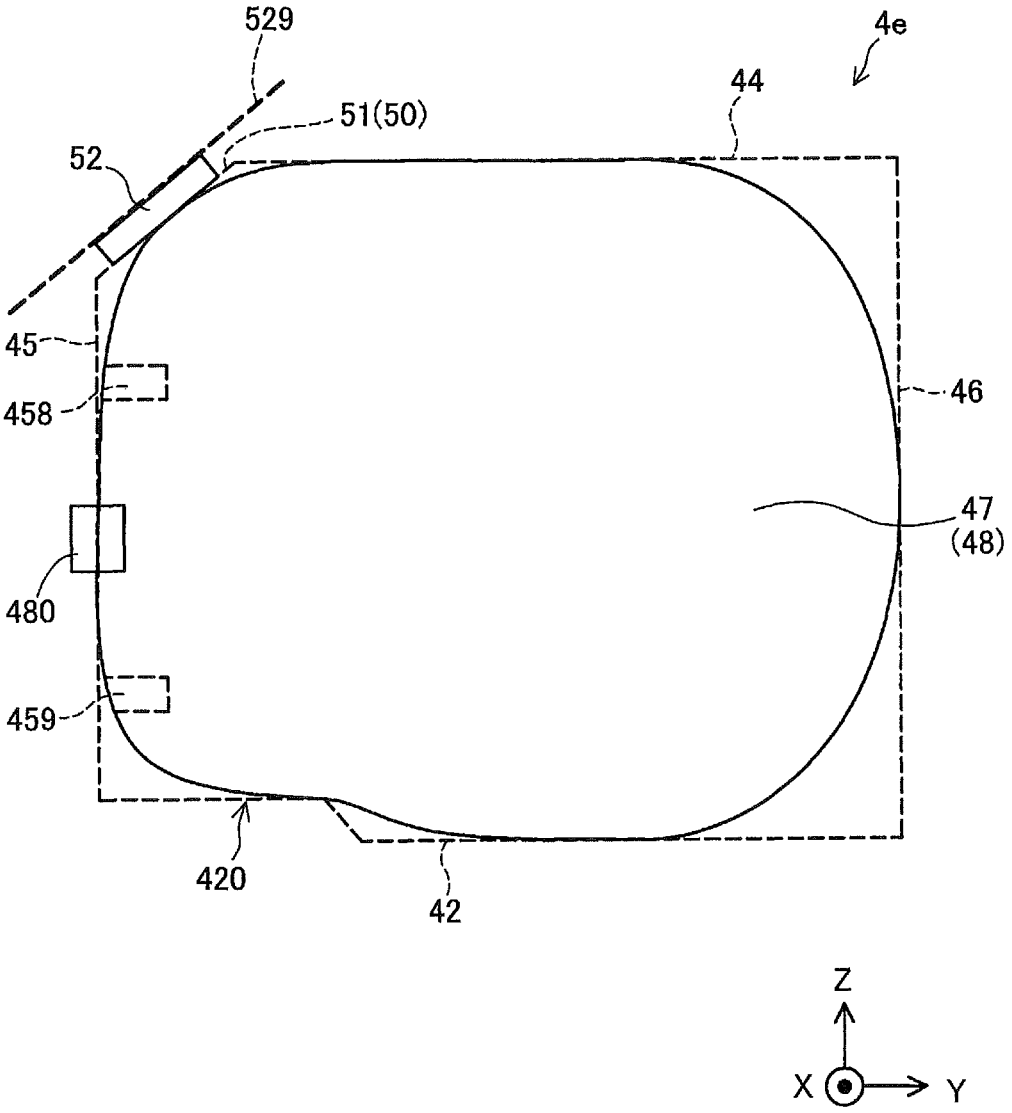


Fig.33

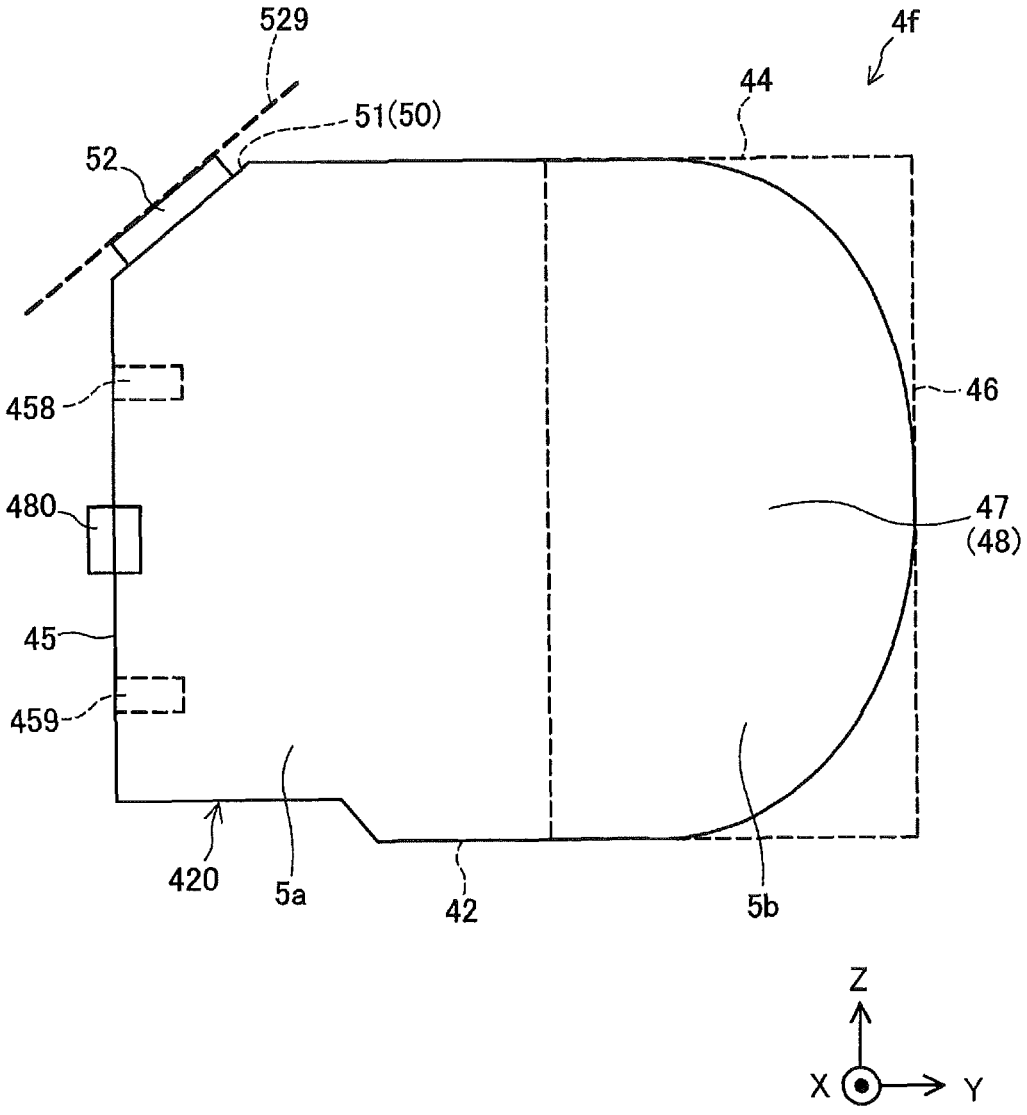
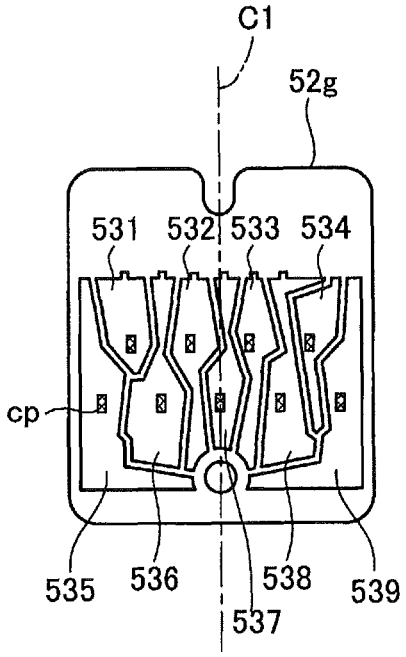


Fig.34


C1
52g
531
532
533
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cp
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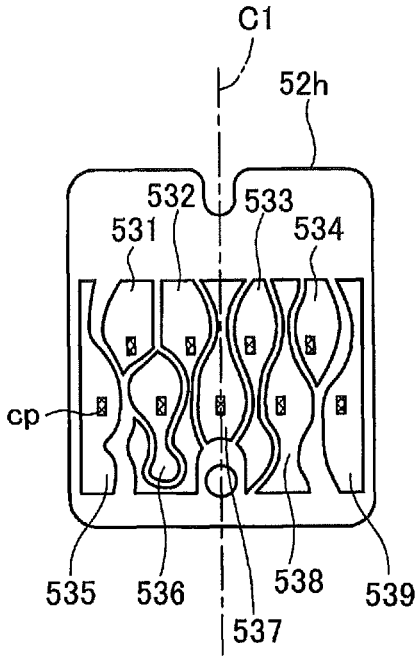
536
537
538
539

Fig.35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cp
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537
538
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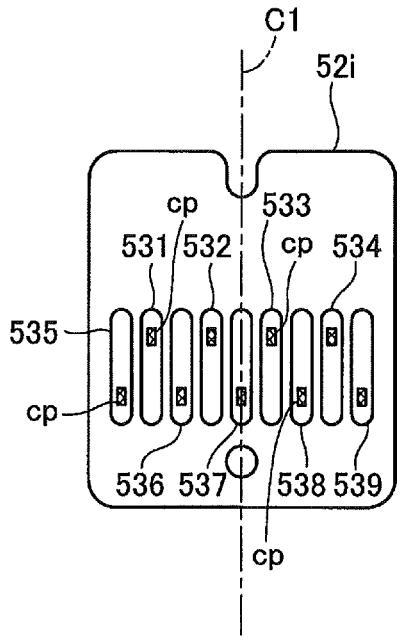
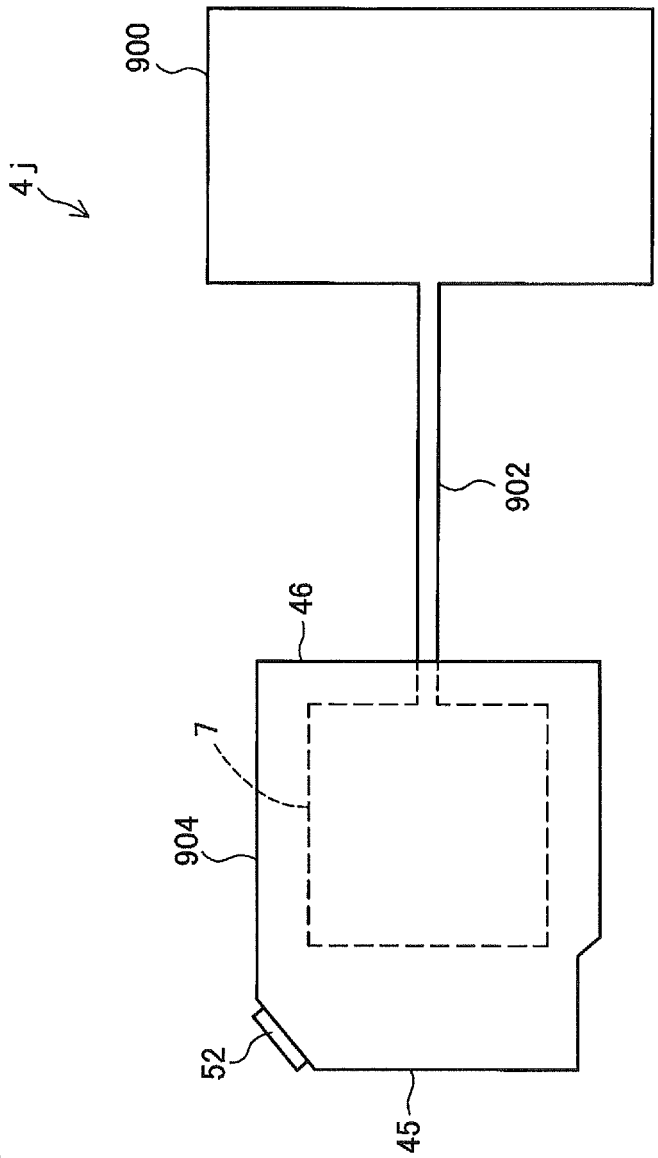
Fig.36





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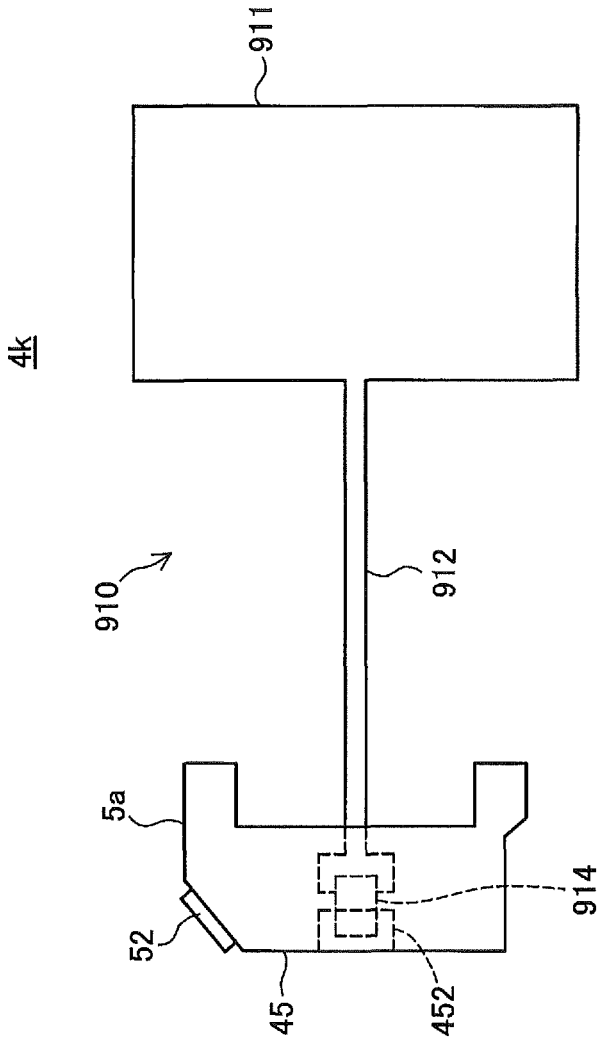

Fig.38

CARTRIDGE AND PRINTING MATERIAL SUPPLY SYSTEM

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority to Japanese Patent Applications No. 2013-103008 filed on May 15, 2013 and No. 2014-24059 filed on Feb. 12, 2014, the entire contents of which are incorporated by reference herein.

TECHNICAL FIELD

The present invention relates to a cartridge-related technology for containing a printing material.

BACKGROUND ART

There has been conventionally known technology using an ink cartridge that contains ink (also simply called "cartridge"), as the technology of supplying ink to a printer as one example of printing devices. The cartridge includes: a printing material container that contains ink as a printing material; and a printing material supplier that supplies ink contained in the printing material container to the printer. The cartridge is configured to be attached to and detached from the printing device.

A known structure of the cartridge has: a circuit board located on a first side face; and a cartridge-side engagement structure located on a second side face opposed to the first side face (for example, JP 2008-137376A). The circuit board has contact portions that are in contact with those of the printing device. The cartridge-side engagement structure is engaged with a device-side engagement structure provided on a cartridge holder of the printer, so as to restrict the movement of the cartridge in a direction opposite to the direction of attachment of the cartridge in a releasable manner.

SUMMARY

There may be a variety of problems in the course of attachment and detachment of the cartridge with the cartridge-side engagement structure to and from the cartridge holder. More specifically, when the cartridge is attached to the cartridge holder, an external force is applied from the cartridge holder to clamp the cartridge on their first side face and the second side face. An excessive increase of this external force may make it difficult to detach the cartridge from the cartridge holder. Unbalance of the external force for clamping the cartridge may cause the cartridge to be tilted or rotated and may thus make it difficult to detach the cartridge from the cartridge holder. Additionally, such tilt or rotation may cause a contact failure between the contact portions on the circuit board and the printing device.

In order to solve at least part of the problems described above, the invention may be implemented by the following aspects.

(1) According to one aspect of the invention, there is provided a cartridge configured to supply a printing material to a printing device. This cartridge comprises: a printing material container that is capable of containing the printing material; a printing material supplier that supplies the printing material contained in the printing material container to the printing device; a first surface and a second surface that are opposed to each other; a third surface that intersects with the first surface and the second surface; a fourth surface that is opposed to the third surface; a cartridge-side engagement structure that is provided on the third surface at a position closer to the first surface than the second surface and is configured to be engaged with a device-side engagement structure of the printing device; and contact portions that are provided in an area where both an end of the first surface proximate to the fourth surface and an end of the fourth surface proximate to the first surface are located and are configured to be in contact with the printing device. A contact surface defined by the contact portions is inclined to the fourth surface.

In the cartridge according to this aspect, the contact surface is not parallel to the fourth surface but is inclined to the fourth surface along a predefined direction. This reduces the force applied to the cartridge in a cartridge clamping direction, even when force is applied from the printing device to the cartridge by contact between the contact portions with the printing device or engagement of the cartridge-side engagement structure with the device-side engagement structure of the printing device. This accordingly enables the cartridge to be readily detached from the printing device.

(2) One embodiment of the cartridge of the above aspect may further comprise: a fifth surface that intersects with the first surface, the second surface, the third surface and the fourth surface; a sixth surface that is opposed to the fifth surface; and a plurality of terminals, each comprising one of the contact portions. The contact portions may be arranged to form at least one array in a width direction in which the fifth surface and the sixth surface are opposed to each other. The plurality of terminals may include a first terminal having a first contact portion located at a center of the array. An engagement portion which is a portion of the cartridge-side engagement structure to be engaged with the device-side engagement structure may be located on a virtual plane, the virtual plane passing through the first terminal and being perpendicular to the width direction.

In the cartridge of this embodiment, the engagement portion is located at the position on the virtual plane that passes through the first terminal and is perpendicular to the width direction. The cartridge is positioned relative to the printing device to some extent by engagement of the engagement portion with the device-side engagement structure. Locating the engagement portion on the virtual plane thus enables the plurality of terminals to be positioned relative to the printing device with high accuracy. Locating the engagement portion on the virtual plane also enables the cartridge to be clamped by the engagement portion and the first terminal on the virtual plane, thus suppressing rotation or tilt of the cartridge. This enables the cartridge to be readily detached from the printing device.

(3) In the cartridge of the above embodiment, the printing material supplier may include a supply port at one end, the supply port being located at a position on the virtual plane.

A flow tube which is a part of the printing device is inserted through the supply port into the printing material supplier. Insertion of the flow tube into the printing material supplier also positions the cartridge relative to the printing device. In the cartridge of this embodiment, locating the supply port at the position on the virtual plane enables the plurality of terminals to be positioned relative to the printing device with high accuracy. Accurate positioning of the cartridge relative to the printing device by the supply port enables the engagement portion and the first terminal located on the virtual plane to be arranged at designed positions with high accuracy. This enables the cartridge to be stably clamped by the engagement portion and the first terminal and thereby suppresses rotation or tilt of the cartridge. Suppressing the rotation or tilt of the cartridge enables the cartridge to be readily detached from the printing device.

(4) In the cartridge of the above embodiment, the first contact portion may be located at a position on the virtual plane.

In the cartridge of this embodiment, the first contact portion located at the center in the width direction among the plurality of contact portions is located on the virtual plane, so that the plurality of terminals are enabled to be positioned relative to the printing device with high accuracy. Locating the supply port at the position on the virtual plane enables the cartridge to be clamped by the engagement portion and the first contact portion on the virtual plane and thereby suppresses rotation or tilt of the cartridge. This enables the cartridge to be readily detached from the printing device.

(5) In another embodiment of the cartridge of the above aspect, the printing material supplier may include a supply port at one end, the supply port being located at a position closer to the third surface than the fourth surface.

In the cartridge of this embodiment, the supply port is located at the position closer to the third surface side than the fourth surface side. This locates the supply port at a distance from the contact portion disposed in a corner section where the first surface intersects with the fourth surface. This reduces the likelihood that the contact portions are stained with the printing material even in the event of leakage of the printing material from the supply port. This ensures the good contact between the contact portions and the printing device.

(6) In another embodiment of the cartridge of the above aspect, the third surface may have: a one-end-side face that is connected with the second surface; and an other-end-side face that is connected with the first surface and is located at a position closer to the fourth surface than the one-end-side face, and the cartridge-side engagement structure may be formed on the other-end-side face.

In the cartridge of this embodiment, the cartridge-side engagement structure is formed on the other-end-side face that is located at the position closer to the fourth surface than the one-end-side face. This allows for reduction of the first surface-side dimension of the cartridge in the direction in which the third surface and the fourth surface are opposed to each other. Reduction of the first surface-side dimension of the cartridge ensures the sufficient space in a location where the device-side engagement structure of the printing device is located. This reduces the likelihood of a contact failure between the printing device and the contact portions on a circuit board.

(7) In another embodiment of the cartridge of the above aspect, the printing device may comprise: a flow tube that is inserted into the printing material supplier; and the printing material supplier may include a supply port at one end, the supply port coming to be located above the printing material receiver in a state prior to engagement of the cartridge-side engagement structure with the device-side engagement structure.

In the cartridge of this embodiment, the supply port is located above the printing material receiver in the state prior to engagement of the cartridge-side engagement structure with the device-side engagement structure. Even in the event of leakage of the printing material from the supply port toward the third surface, this arrangement enables the printing material receiver to trap the leaked printing material. This reduces the likelihood that the cartridge-side engagement structure and the device-side engagement structure located below the supply port are stained with the printing material, while enabling the cartridge to be adequately clamped and suppressing rotation or tilt of the cartridge.

(8) In another embodiment of the cartridge of the above aspect, the printing device may comprise: a flow tube that receives the printing material; and a printing material receiver that traps the printing material, and the printing material supplier includes a supply port at one end and the third surface coming to a positional relationship where the printing material receiver is between the supply port and the third surface in a state prior to engagement of the cartridge-side engagement structure with the device-side engagement structure.

In the cartridge of this embodiment, the supply port and the third surface come to the positional relationship where the printing material receiver is between the supply port and the third surface in a state prior to engagement of the cartridge-side engagement structure with the device-side engagement structure. Even in the event of leakage of the printing material from the supply port toward the third surface, this positional relationship enables the printing material receiver to trap the leaked printing material. This reduces the likelihood that the cartridge-side engagement structure and the device-side engagement structure located below the supply port are stained with the printing material, while enabling the cartridge to be adequately clamped and suppressing rotation or tilt of the cartridge.

(9) In the cartridge of the above embodiment, the cartridge-side engagement structure may be a groove structure formed on the third surface. The cartridge-side engagement structure may comprise: a receiver portion that is extended from the first surface toward the second surface and is configured to receive the device-side engagement structure; and a guide portion that is connected with the receiver portion, is extended in a direction inclined to a direction of attachment of the cartridge in the course of attachment of the cartridge to the printing device and is configured to guide the device-side engagement structure to an engagement position where the device-side engagement structure is engaged with the cartridge-side engagement structure. The guide portion may be shorter than the printing material receiver in a direction in which the first surface and the second surface are opposed to each other.

In the cartridge of this embodiment, the guide portion is shorter than the printing material receiver. The printing material receiver can thus trap the printing material leaked from the supply port toward the third surface, at least when the device-side engagement structure is located at the guide portion. This reduces the likelihood that the cartridge-side engagement structure and the device-side engagement structure located below the supply port are stained with the printing material, while enabling the cartridge to be adequately clamped and suppressing rotation or tilt of the cartridge.

(10) An embodiment of the cartridge of the above aspect may further comprise a container main body that defines the first surface to the fourth surface and accommodates the printing material container inside thereof. The container main body may comprise: a first container body that includes the first surface but does not include the second surface; and a second container body that includes the second surface but does not include the first surface and is configured to be detachable from the first container body. The cartridge-side engagement structure may be formed on the first container body.

This arrangement suppresses a contact failure between the printing device and the contact portions on a circuit board caused by, for example, rattling of the second container body, while suppressing rotation or tilt of the cartridge.

(11) In the cartridge of the above embodiment, the first container body may have a projection protruded toward the second container body. At least part of the cartridge-side

engagement structure may be formed on the projection. The projection and the second container body may have a play therebetween.

In the cartridge of this embodiment, at least part of the cartridge-side engagement structure is formed on the projection that is protruded toward the second container body, and there is some play between the projection and the second container body. This arrangement suppresses a contact failure between the printing device and the contact portions on a circuit board caused by, for example, rattling of the second container body, while suppressing rotation or tilt of the cartridge.

(12) According to another aspect of the invention, there is provided a printing material supply system including a printing device and a cartridge. The printing material supply system of this aspect comprises: the cartridge according to any of the aspect and embodiments described above; and a printing device that has a flow tube that is to be inserted into the printing material supplier. The printing device comprises: a device-side engagement structure that is to be engaged with the cartridge-side engagement structure; and a contact mechanism that is to be in contact with the contact portions.

The printing material system of this aspect enables the cartridge to be readily detached from the printing device.

The plurality of components included in each aspect of the invention described above are not all essential, but some components among the plurality of components may be appropriately changed, omitted or replaced with other components or part of the limitations may be deleted, in order to solve part or all of the problems described above or in order to achieve part or all of the advantageous effects described herein. In order to solve part or all of the problems described above or in order to achieve part or all of the advantageous effects described herein, part or all of the technical features included in one aspect of the invention described above may be combined with part or all of the technical features included in another aspect of the invention described above to provide still another independent aspect of the invention.

For example, one aspect of the invention may be implemented as a device comprises: one or more components among the plurality of components including the printing material container, the printing material supplier, the first surface, the second surface, the third surface, the fourth surface, the cartridge-side engagement structure and the contact portions. This device may include or may not include the printing material container. This device may include or may not include the printing material supplier. This device may include or may not include the first surface. This device may include or may not include the second surface. This device may include or may not include the third surface. This device may include or may not include the fourth surface. This device may include or may not include the cartridge-side engagement structure. This device may include or may not include the contact portions. This device may be provided as a cartridge or may be provided as a device other than cartridge.

The invention may be implemented by any of various aspects: for example, a cartridge, a printing material supply system, a production method of a cartridge, a production method of a printing material supply system, and a unit including a cartridge and a cartridge holder which the cartridge is removably attached to.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view illustrating the schematic configuration of a printing material supply system;

FIG. **2** is a front view of a cartridge holder in the state of attachment;

FIG. **3** is an F2-F2 cross sectional view of FIG. **2**;

FIG. **4** is a front view of the cartridge holder;

FIG. **5** is first external perspective view of the cartridge holder;

FIG. **6** is a second external perspective view of the cartridge holder;

FIG. **7** is a side view of the cartridge holder;

FIG. **8** is an F4-F4 cross sectional view of FIG. **4**;

FIG. **9** is a diagram illustrating a device-side engagement structure;

FIG. **10** is a first external perspective view of a cartridge;

FIG. **11** is a second external perspective view of the cartridge;

FIG. **12** is a front view of a circuit board;

FIG. **13** is a side view of the circuit board;

FIG. **14** is a front view of the cartridge;

FIG. **15** is a top view of the cartridge;

FIG. **16** is a first side view of the cartridge;

FIG. **17** is a bottom view of the cartridge;

FIG. **18** is a rear view of the cartridge;

FIG. **19** is a partial enlarged view of FIG. **17**;

FIG. **20** is an exploded perspective view of the cartridge;

FIG. **21** is an exploded perspective view of a flow path unit;

FIG. **22** is a first explanatory diagram;

FIG. **23** is a second explanatory diagram;

FIG. **24** is a third explanatory diagram;

FIG. **25** is a first diagram illustrating the advantageous effects;

FIG. **26** is a second diagram illustrating the advantageous effects;

FIG. **27** is a diagram illustrating a printing material container according to a second embodiment;

FIG. **28** is an F27-F27 cross sectional view of FIG. **27**;

FIG. **29** is a diagram illustrating a modification of the second embodiment;

FIG. **30** is a diagram conceptually illustrating a modification with respect to a contact surface of the cartridge;

FIG. **31**A is a diagram conceptually illustrating another modification with respect to the contact surface of the cartridge;

FIG. **31**B is a diagram illustrating one example of a virtual contact surface;

FIG. **31**C is a diagram of FIG. **31**B viewed from the −X-axis direction;

FIG. **31**D is a diagram illustrating another example of the virtual contact surface;

FIG. **32** is a diagram conceptually illustrating a modification with respect to the shape of the cartridge;

FIG. **33** is a diagram conceptually illustrating another modification with respect to the shape of the cartridge;

FIG. **34** is a diagram illustrating a modification with respect to the shape of the terminals on the circuit board;

FIG. **35** is a diagram illustrating another modification with respect to the shape of the terminals on the circuit board;

FIG. **36** is a diagram illustrating another modification with respect to the shape of the terminals on the circuit board;

FIG. **37** is a diagram illustrating a second modification; and

FIG. **38** is a diagram illustrating a third modification.

DESCRIPTION OF EMBODIMENTS

The following describes embodiments of the invention in the following sequence:

A, B: Embodiments

C, D: Modifications

A. First Embodiment

A-1. Configuration of Printing Material Supply System

FIG. **1** is a perspective view illustrating the schematic configuration of a printing material supply system **1**. XYZ axes orthogonal to one another are illustrated in FIG. **1** and are also given in subsequent drawings as appropriate. The XYZ axes in FIG. **1** correspond to the XYZ axes in the other drawings. The printing material supply system **1** includes a cartridge **4** and a printer **10** as a printing device. In the printing material supply system **1**, the cartridge **4** is removably attached to a cartridge holder **6** of the printer **10**.

The printer **10** of the embodiment is an inkjet printer that ejects ink as a printing material from a head **22**. The printer **10** has a cartridge holder **6**, a controller **31**, a carriage **20**, a head **22** and a drive mechanism **30**. The printer **10** also has operation buttons **15** manipulated by the user for the operations of the printer **10**.

A plurality of cartridges **4** are respectively attached removably to the cartridge holder **6**. According to this embodiment, four different types of cartridges **4** corresponding to four different color inks (black, yellow, magenta and cyan), one for each, i.e., the total of four cartridges **4**, are attached to the cartridge holder **6**. The printer **10** of the embodiment has a cover for replacement **13** on a front surface (surface on +Y-axis direction side). When a +Z-axis direction side of the cover for replacement **13** is pulled forward (toward +Y-axis direction side), the opening of the cartridge holder **6** is made accessible to allow for attachment and detachment of the cartridges **4**. When the cartridge **4** is attached to the cartridge holder **6**, ink can be supplied through a tube **24** to the head **22** provided on the carriage **20**. According to this embodiment, a pump mechanism (not shown) in the printer **10** serves to suck the ink in the cartridge **4** and supply the sucked ink to the head **22**. The tubes **24** are provided for the respective ink types. Here the state that the cartridge **4** is attached to the cartridge holder **6** is called "state of attachment".

The head **22** has nozzles provided for each ink type. The head **22** serves to eject the ink from the ejection nozzles toward a printing sheet **2** to print data such as characters and images. The process of attaching the cartridge **4** to the cartridge holder **6** and the detailed structures of the cartridge **4** and the cartridge holder **6** will be described later. According to this embodiment, the printer **10** is a so-called "off-carriage type" printer in which the cartridge holder **6** does not move in conjunction with the move of the carriage **20**. The invention is also applicable to a so-called "on-carriage type" printer in which the cartridge holder **6** is provided on the carriage **20** and moves along with the carriage **20**.

The controller **31** serves to control the respective components of the printer **10** and send and receive signals to and from the cartridge **4**. The carriage **20** serves to move the head **22** relative to the printing sheet **2**.

The drive mechanism **30** serves to move back and forth the carriage **20** in response to control signals from the controller **31**. The drive mechanism **30** includes a timing belt **32** and a drive motor **34**. The power of the drive motor **34** is transmitted via the timing belt **32** to the carriage **20** to move the carriage **20** back and forth in a main scanning direction (X-axis direction). The printer **10** also has a conveyance mechanism to move the printing sheet **2** in a sub-scanning direction (+Y-axis direction). The printing sheet **2** is moved in the sub-scanning direction by the conveyance mechanism during printing, and the printing sheet **2** after printing is delivered onto a front cover **11**.

An area called home position is provided at a location out of a printable area, to which the carriage **20** is moved in the main scanning direction. A maintenance mechanism for maintenance to ensure normal printing is mounted on the home position. The maintenance mechanism includes a cap member **8**, a lift mechanism (not shown) and a suction pump (not shown). The cap member **8** is pressed against a nozzle-forming surface (nozzle surface) on a bottom face side of the head **22** (side facing the printing sheet **2**) to define a closed space surrounding the ejection nozzles. The lift mechanism lifts up and down the cap member **8** to be pressed against the nozzle surface of the head **22**. The suction pump introduces a negative pressure into the closed space defined by pressing the cap member **8** against the nozzle surface of the head **22**.

According to the embodiment, in the use state of the printing material supply system **1**, an axis along the sub-scanning direction in which the printing sheet **2** is conveyed is Y axis; an axis along the direction of gravity (vertical direction) is Z axis; and an axis along the moving direction of the carriage **20** (longitudinal direction) is X axis. The "use state of the printing material supply system **1**" herein denotes the state that the printing material supply system **1** is placed on a horizontal plane. According to this embodiment, the sub-scanning direction (forward direction) is +Y-axis direction; and its reverse direction (backward direction) is −Y-axis direction. A direction from bottom to top in the direction of gravity (upward direction) is +Z-axis direction; and its reverse direction (downward direction) is −Z-axis direction. When the printing material supply system **1** is viewed from the front side (+Y-axis direction side), a direction from right to left is +X-axis direction; and its reverse direction is −X-axis direction. According to this embodiment, the direction of attachment of the cartridge **4** to the cartridge holder **6** is −Y-axis direction, and the direction of detachment of the cartridge **4** from the cartridge holder **6** is +Y-axis direction. The −Y-axis direction side of the cartridge holder **6** is thus called back side, and the +Y-axis direction side is called front side. According to this embodiment, the direction of array of the plurality of cartridges **4** in the cartridge holder **6** is X-axis direction.

FIG. **2** is a front view of the cartridge holder **6** in the state of attachment. FIG. **2** illustrates the state that one cartridge **4** is attached to the cartridge holder **6**. In the description below, the X-axis direction of the cartridge holder **6** is also called "width direction; the Z-axis direction is also called "height direction"; and the Y-axis direction is also called "length direction".

The cartridge holder **6** has a cartridge chamber **60** for accommodating the cartridges **4**. Each part of the cartridge chamber **60** for accommodating one of the four cartridges **4** is called a slot **61**. According to this embodiment, the cartridge holder **6** has first to fourth slots **61***a* to **61***d*. The first slot **61***a* has a greater width than those of the other slots **61***b* to **61***d*. The first slot **61***a* is enabled to accommodate a cartridge having a larger dimension in the X-axis direction than that of the cartridge **4** (called "large-capacity cartridge"), as well as the cartridge **4**. The cartridge having the larger dimension in the X-axis direction is enabled to contain a greater volume of ink than that of the cartridge **4**. For example, the large-capacity cartridge may be used to contain frequently-used black ink. The large-capacity cartridge and the cartridge **4** have different dimensions in the X-axis direction and contain different volumes of inks, but otherwise have the same structures.

FIG. **3** is an F2-F2 cross sectional view of FIG. **2**. FIG. **3** illustrates part of the cartridge holder **6** and the cartridge **4**. After attachment of the cartridge **4** to the cartridge holder **6**, a pump mechanism (not shown) is actuated to flow the ink from

a printing material container **7** of the cartridge **4** to the printing device **10** as shown by an arrow. More specifically, the ink in the printing material container **7** flows from a printing material supplier **482** of the cartridge **4** to a flow tube **702** of the cartridge holder **6**.

In the state that the cartridge **4** is attached to the cartridge holder **6** (in the state of attachment), a plurality of contact portions cp (only one is illustrated in FIG. **3**) provided on a surface **52***a* of a circuit board **52** of the cartridge **4** are in contact with a plurality of corresponding device-side terminals **803** (only one is illustrated in FIG. **3**) provided on the cartridge holder **6**. A contact surface **529** defined by the plurality of contact portions cp is a plane inclined along a predefined direction. More specifically, the contact surface **529** is inclined in a direction including a +Z-axis direction component (vertically upward direction) and a −Y-axis direction component (direction of attachment). In other words, the contact surface **529** is inclined to a fourth surface **44** of the cartridge **4**, such as to approach from a first surface **45** to a second surface **46** of the cartridge **4** accompanied with an approach from a third surface **42** toward the fourth surface **44**. According to this embodiment, the contact surface **529** is located to be almost flush with a plane where the contact portions cp are arranged (in this embodiment, the surface **52***a* of the circuit board **52**). The contact surface **529** may be inclined at an angle "a" between the fourth surface **44** which is a horizontal plane and the contact surface **529** in the range of 30 degrees to 60 degrees. According to this embodiment, the angle "a" between the fourth surface and the contact surface **529** is about 40 degrees.

In the state of attachment, a device-side engagement structure **75** provided on the cartridge holder **6** is engaged with a cartridge-side engagement structure **420** provided on the third surface **42** of the cartridge **4**. Such engagement restricts the move of the cartridge **4** in the +Y-axis direction.

In the state of attachment, the cartridge **4** receives external forces Fs, Ft, Fp and Fr from the cartridge holder **6**. The external force Fs is a force applied from the device-side terminals **803** to the cartridge **4**. The external force Fs is set to have a predefined angle to the contact surface **529**. According to this embodiment, the external force Fs is a force applied almost perpendicularly to the contact surface **529** (i.e., the surface **52***a* of the circuit board **52**). The external force Ft is a force applied from the device-side engagement structure **75** to the cartridge **4**. In order to ensure the good contact between the device-side terminals **803** and the contact portions cp, there is a need to press the contact portions cp by sufficiently applying the elastic force of the device-side terminals **803** to the contact portions cp. According to this embodiment, for this purpose, the external force (elastic force) applied from the device-side terminals **803** to the contact portions cp is set to be almost perpendicular to the contact surface **529**.

The external force Ft is a force applied in the direction of pressing up the cartridge **4** (+Z-axis direction). More specifically, the external force Ft is a force applied almost perpendicularly to the third surface **42**. In other words, the direction of the external force Ft is almost vertically upward direction. The external force Fr is a force applied from the device-side engagement structure **75** to the cartridge **4**. The external force Fr is a force of pressing the cartridge **4** in the −Y-axis direction (direction of attachment). The external force Fr is produced by engagement of the device-side engagement structure **75** with the cartridge-side engagement structure **420** of the cartridge **4**. The external force Fp is a force applied from a cover member **706** of the cartridge holder **6** to the cartridge **4**. The external force Fp is a force applied almost perpendicularly to the first surface **45** of the cartridge **4**. In other words, the external force Fp is a force of pressing the cartridge **4** in the +Y-axis direction (direction of detachment). The resultant force of the external force Fp and a force component Fs1 in the +Y-axis direction of the external force Fs is the force of moving the cartridge **4** in the +Y-axis direction. Application of the external force Ft to the cartridge **4**, on the other hand, restricts the move of the cartridge **4** in the Y-axis direction.

The external force Ft and a force component Fs2 in the −Z-axis direction of the external force Fs are respectively the forces of clamping the cartridge **4**. In other words, the external force Ft and the force component Fs2 are respectively the forces acting in the directions perpendicular to the direction of detachment of the cartridge **4** (+Y-axis direction). Increasing the external force Ft or the force component Fs2 makes it difficult to readily detach the cartridge **4** from the cartridge holder **6**.

A-2. Detailed Structure of Cartridge Holder

The following describes the detailed structure of the cartridge holder **6** with reference to FIGS. **4** to **9**. FIG. **4** is a front view of the cartridge holder **6**. FIG. **5** is first external perspective view of the cartridge holder **6**. FIG. **6** is a second external perspective view of the cartridge holder **6**. FIG. **7** is a side view of the cartridge holder **6**. FIG. **8** is an F4-F4 cross sectional view of FIG. **4**. FIG. **9** is a diagram illustrating the device-side engagement structure **420**. For the clarity of explanation, part of the structure of the cartridge holder **6** is omitted from the illustration of FIG. **7** to make the internal configuration of the cartridge holder **6** visible. Part of the structure of the cartridge holder **6** is also omitted from the illustration of FIG. **9** to make the configuration of the device-side engagement structure visible.

As shown in FIGS. **5** and **6**, the cartridge holder **6** has six walls **62**, **64**, **65**, **66**, **67** and **68** described below. The cartridge chamber **60** is defined and formed by the six walls **62**, **64**, **65**, **66**, **67** and **68**. The six walls **62**, **64**, **65**, **66**, **67** and **68** are respectively formed in almost rectangular outer shapes. The wall **65** is also called "device-side first wall **65**" or "device-side rear wall **65**". The wall **66** is also called "device-side second wall **66**" or "device-side front wall **66**". The wall **62** is also called "device-side third wall **62**" or "device-side bottom wall **62**". The wall **64** is also called "device-side fourth wall **64**" or "device-side upper wall **64**". The wall **67** is also called "device-side fifth wall **67**" or "device-side first side wall **67**". The wall **68** is also called "device-side sixth wall **68**" or "device-side second side wall **68**". Each of the walls **62**, **64**, **65**, **66**, **67** and **68** may be comprised of a single wall member or may be comprised of a plurality of wall members in combination.

As shown in FIG. **7**, the device-side first wall **65** and the device-side second wall **66** are opposed to each other across the cartridge chamber **60**. The device-side third wall **62** and the device-side fourth wall **64** are opposed to each other across the cartridge chamber **60**. The device-side fifth wall **67** and the device-side sixth wall **68** are opposed to each other across the cartridge chamber **60**. The device-side first wall **65** is located on the −Y-axis direction side of the cartridge chamber **60**. The device-side second wall **66** is located on the +Y-axis direction side of the cartridge chamber **60**. The device-side third wall **62** is located on the −Z-axis direction side of the cartridge chamber **60**. The device-side fourth wall **64** is located on the +Z-axis direction side of the cartridge chamber **60**. The device-side fifth wall **67** is located on the +X-axis direction side of the cartridge chamber **60**. The device-side sixth wall **68** is located on the −X-axis direction side of the cartridge chamber **60**.

As shown in FIGS. **5** and **6**, the cartridge holder **6** is formed in an external of almost rectangular parallelepiped. The device-side first wall **65**, the device-side second wall **66**, the device-side fifth wall **67** and the device-side sixth wall **68** are almost vertical walls in the use state. The device-side third wall **62** and the device-side fourth wall **64** are almost horizontal walls in the use state.

The device-side second wall **66** has an opening OP (FIG. **8**), which the cartridge **4** passes through in the course of attachment to the cartridge holder **6**. The cartridge **4** is moved along the Y-axis direction for attachment or detachment of the cartridge **4**. More specifically, the −Y-axis direction is the direction of attachment of the cartridge **4** to the cartridge holder **6**. The +Y-axis direction is the direction of detachment of the cartridge **4** from the cartridge holder **6**.

As shown in FIGS. **4** and **7**, a contact mechanism **80**, a flow unit **70** and first and second positioning members **76** and **78** are provided on the device-side first wall **65**. The respective portions **80**, **70**, **76** and **78** are provided for each of the slots **61***a* to **61***d*. As shown in FIG. **4**, the contact mechanism **80**, the first positioning member **76**, the flow unit **70** and the second positioning member **78** are arranged in this order from the side close to the device-side second wall **64**. The first positioning member **76** and the second positioning member **78** are located at the positions across the flow unit **70** in the Z-axis direction.

As shown in FIGS. **6** to **8**, the contact mechanism **80** includes a device-side terminal group **802**, a connector base plate **804** (FIG. **8**), a terminal holding member **81** and a pressing member **806** (FIG. **8**). The device-side terminal group **802** is comprised of nine device-side terminals **803**. As shown in FIG. **8**, each of the nine device-side terminals **803** is a plate-like member and is elastically deformed. More specifically, one end **812** of the device-side terminal **803** is elastically deformed about a bent **818** in the direction of an arrow R1. The direction of the arrow R1 is a direction parallel to the Y-axis direction and the Z-axis direction. The one end **812** of the device-side terminal **803** is held by the terminal holding member **81** such as to be exposed on the surface of the terminal holding member **81**. The other end **813** of the device-side terminal **803** is in contact with the connector base plate **804** to be electrically connected. The connector base plate **804** is also electrically connected with the controller **31** of the printer **10**. The one end **812** of the device-side terminal **803** is in contact with a corresponding cartridge-side terminal provided on the cartridge **4** to be electrically connected in the state of attachment of the cartridge **4**.

As shown in FIG. **6**, the terminal holding member **81** holds the device-side terminal group **802**. More specifically, the terminal holding member **81** holds the device-side terminal group **802** (more specifically, a terminal base which the device-side terminal group **802** is fixed to) to be slightly movable in the Z-axis direction and in the X-axis direction. A pair of members **810** and **811** are provided on the respective side faces in the X-axis direction of the terminal holding member **81**. The pair of members **810** and **811** are columnar members extended in the Y-axis direction. The pair of members **810** and **811** are inserted into grooves formed in the vicinity of the circuit board **52** of the cartridge **4** in the course of attachment of the cartridge **4** to the cartridge holder **6**. The pressing member **806** shown in FIG. **6** is a helical compression spring. The pressing member **806** presses the terminal holding member **81** in the +Y-axis direction. As shown in FIG. **6**, engagement of engagement claws **807** provided on the respective side faces in the X-axis direction of the terminal holding member **81** with engagement walls **651** provided on the device-side first wall **65** restricts the move of the terminal holding member **81** in the +Y-axis direction. Application of an external force in the −Y-axis direction allows the terminal holding member **81** to move in the −Y-axis direction against the pressing force of the pressing member **806**.

As described above, the device-side terminals **803** are movable in the three directions, i.e., the X-axis direction, the Y-axis direction and the Z-axis direction. Moving the device-side terminals **803** in these three directions finely adjusts the position of the device-side terminals **803** relative to the position of the cartridge-side terminals, thus ensuring the good contact between the cartridge-side terminals and the device-side terminals **803**.

As shown in FIGS. **5**, **6** and **8**, the first positioning member **76** and the second positioning member **78** are columnar members extended in the +Y-axis direction from the device-side first wall **65**. The first and the second positioning members **76** and **78** are inserted into first and second member through holes provided on the cartridge **4** as described later.

As shown in FIGS. **5** and **8**, the flow unit **70** includes a flow tube **702**, a cover member **706** and a pressing member **712** (FIG. **8**). The flow tube **702** is inserted into the printing material supplier **482** of the cartridge **4**. Such insertion connects the flow tube **702** with the printing material supplier **482** of the cartridge **4** and causes the ink in the cartridge **4** to flow through the flow tube **702** into the printing device **10**. As shown in FIG. **8**, the flow tube **702** internally has a flow path **702***d* of circular cross section. A connection hole **702***c* which causes the flow path **702***d* to communication with the outside is formed on the −Z-axis direction side of the circumference of the flow tube **702**. The ink in the cartridge **4** flows through the connection hole **702***c* into the printing device **10**. The flow tube **702** has a center axis CA, which is extended along the Y-axis direction. The flow tube **702** has a base end **702***a* located on the device-side first wall **65**-side and a front end **702***b* located on the device-side second wall **66**-side. The direction from the base end **702***a* toward the front end **702***b* is the +Y-axis direction.

As shown in FIG. **8**, the cover member **706** surrounds part of the periphery of the flow tube **702**. The cover member **706** also has a printing material receiver **710** formed in a concave shape. In the event of leakage of ink from the flow tube **702** or from the printing material supplier **482** of the cartridge **4**, the printing material receiver **710** receives and thereby traps the leaked ink. The pressing member **712** is a helical compression spring. The pressing member **712** presses the cover member **706** in the +Y-axis direction. Application of an external force in the −Y-axis direction allows the cover member **706** to move in the −Y-axis direction against the pressing force of the pressing member **712**. The printing material receiver **710** is located on the −Z-axis direction side of (immediately below) a printing material supply tube **642**, irrespective of displacement from the state prior to attachment of the cartridge **4** to the state of attachment. More specifically, the printing material receiver **710** is located on the −Z-axis direction side of (immediately below) a connection hole **648**, irrespective of the move of the cover member **706** from the state prior to attachment of the cartridge **4** to the state of attachment. Even in the event of leakage of ink from the flow tube **702**, the printing material receiver **710** traps the ink and thereby reduces the likelihood of ink splash over a wide area. The printing material receiver **710** has a length L1 in the Y-axis direction, which is greater than length L2 of a guide member **606** (FIG. **19**) described later.

As shown in FIGS. **6** and **8**, a first rail mechanism **89** and a device-side identification member **82** are provided on the device-side fourth wall **64**. The respective elements **89** and **82** are provided for each of the slots **61***a* to **61***d*. The first rail

mechanism **89** guides the cartridge **4** to the position of attachment while restricting the move of the cartridge **4** in the width direction (X-axis direction) in the course of attachment of the cartridge **4** to the cartridge holder **6**. As shown in FIG. **6**, the first rail mechanism **89** includes a pair of rail members **86** and **87** arranged at a specified interval in the X-axis direction. The pair of rail members **86** and **87** are members protruded from the device-side fourth wall **64** toward the cartridge chamber **60** and are extended along the Y-axis direction.

The device-side identification member **82** is used to identify whether the right type (right ink color according to the embodiment) of the cartridge **4** is inserted into each of the slots **61***a* to **61***d* of the cartridge chamber **60**. The device-side identification member **82** is located on the device-side first wall **65**-side (−Y-axis direction side) of the first rail mechanism **89**. The respective device-side identification members **82** are formed in different shapes according to the colors of inks in the cartridges **4** to be attached (shown in the same shape for the convenience of illustration in FIG. **6**). More specifically, as shown in FIG. **6**, each device-side identification member **82** is formed by at least one rib (projection). The respective device-side identification members **82** have different patterns, which are determined by the number and the positions of ribs, according to the respective types of the cartridges **4** to be attached. An identification member **424** comprised of ribs (called "cartridge-side identification member") is also provided on the cartridge **4** (FIG. **10**). The identification member **424** of the cartridge **4** is formed in a different shape according to the color of ink contained in the cartridge **4**. In the case that the right type of cartridge **4** is inserted into the slot **61**, the device-side identification member **82** and the cartridge-side identification member **424** are fit to each other without collision. When the wrong type of cartridge **4** is inserted into the slot **61**, on the other hand, the device-side identification member **82** and the cartridge-side identification member **424** collide with each other to interfere with further insertion of the cartridge **4**. This reduces the likelihood that the wrong type of cartridge **4** is inserted into each of the slots **61***a* to **61***d* of the cartridge holder **6**.

As shown in FIGS. **5** and **8**, a second rail mechanism **84** and a device-side engagement structure **75** are provided on the device-side third wall **62**. The respective elements **84** and **75** are provided for each of the slots **61***a* to **61***d*. The second rail mechanism **84** guides the cartridge **4** to the position of attachment while restricting the move of the cartridge **4** in the width direction (X-axis direction) in the course of attachment of the cartridge **4** to the cartridge holder **6**. As shown in FIG. **5**, the second rail mechanism **84** includes a pair of rail members **88** and **89** arranged at a specified interval in the X-axis direction. The pair of rail members **88** and **89** are members protruded from the device-side third wall **62** toward the cartridge chamber **60** and are extended along the Y-axis direction.

The device-side engagement structure **75** is engaged with the cartridge-side engagement structure **420** of the cartridge **4** (FIG. **9**). Such engagement restricts the move of the cartridge **4** in the +Y-axis direction in the state of attachment. As shown in FIGS. **5**, **8** and **9**, the device-side engagement structure **75** includes a lever member **73**, a mounting member **72** (FIG. **9**) and a pressing member **79**.

As shown in FIG. **8**, the lever member **73** is located on the device-side first wall **65**-side of the second rail mechanism **84**. The lever member **73** includes a lever body **77**, a projection **74** and a shaft **71**. The lever body **77** is in a plate-like shape and has elasticity. The lever body **77** is extended horizontally in the state that no cartridge **4** is attached. The shaft **71** is located on a device-side first wall **65**-side (−Y-axis direction side) end of the lever body **77**. The shaft **71** is in a cylindrical shape and is extended in the −Z-axis direction from the lever body **77**. As shown in FIG. **8**, a projection **628** which is a part of the device-side third wall **62** is inserted into a shaft hole of the shaft **71**. Such insertion allows the lever body **77** to rotationally move about the shaft **71** as the axis of rotation. A shaft **71**-side part of the lever member **73** is clamped between the device-side first wall **65** and the device-side third wall **62** in the Z-axis direction. This allows a projection **74**-side part of the lever member **73** to be elastically deformed in a direction RC including the vertical direction.

The projection **74** is a part to be engaged with the cartridge-side engagement structure **420** of the cartridge **4** (FIG. **9**). The projection **74** is located on a device-side second wall **66**-side (+Y-axis direction side) end of the lever body **77**. The projection **74** is protruded from the lever body **77** in the +Z-axis direction. In the state of engagement of the cartridge-side engagement structure **420** with the device-side engagement structure **75** (called "state of engagement"), the projection **74**-side of the lever member **73** is displaced in the −Z-axis direction by an external force from the cartridge **4**. This causes the projection **74** of the lever member **73** to apply the elastic force almost in the +Z-axis direction onto the cartridge **4** in the state of engagement. The state of engagement herein is identical with the state of attachment.

As shown in FIG. **9**, the pressing member **70** is a helical extension spring. The pressing member **79** has one end attached to the mounting member **72** and the other end attached to a part **627** of the device-side third wall **62**. As shown in FIG. **5**, application of an external force against the pressing member **79** to the lever body **77** causes the lever body **77** to be rotated in the direction of an arrow +RB. FIG. **5** illustrates the state of the lever body **77** under no application of the external force (non-load state). Releasing the external force applied to the lever body **77** causes the lever body **77** to be rotated in the direction of an arrow −RB. As described above, the lever body **77** is rotated in a plane parallel to the X-axis direction and the Y-axis direction (horizontal plane).

A-3. External Structure of Cartridge

The following describes the external structure of the cartridge **4** with reference to FIGS. **10** to **19**. FIG. **10** is a first external perspective view of the cartridge **4**. FIG. **11** is a second external perspective view of the cartridge **4**. FIG. **12** is a front view of the circuit board **52**. FIG. **13** is a side view of the circuit board **52**. FIG. **14** is a front view of the cartridge **4**. FIG. **15** is a top view of the cartridge **4**. FIG. **16** is a first side view of the cartridge **4**. FIG. **17** is a bottom view of the cartridge **4**. FIG. **18** is a rear view of the cartridge **4**. FIG. **19** is a partial enlarged view of FIG. **17**. In order to facilitate understanding, the projection **74** of the device-side engagement structure **75** is also illustrated in FIG. **19**. The XYZ axes illustrated in the drawings for description of the cartridge **4** correspond to the XYZ axes of the printing device **10** in the state of attachment.

As shown in FIGS. **10** and **11**, the cartridge **4** is in an external shape of almost rectangular parallelepiped. According to this embodiment, the dimensions of the cartridge **4** decrease in the sequence of the Y-axis direction, the Z-axis direction and the X-axis direction. In the description of this embodiment, the X-axis direction is also called "width direction" of the cartridge **4**; the Y-axis direction is also called "length direction" of the cartridge **4**; and the Z-axis direction is also called "height direction" of the cartridge **4**. The cartridge **4** includes a container main body **450** to internally contain ink. The container main body **450** is a housing formed by molding a synthetic resin such as polypropylene or poly-

styrene. The container main body **450** forms an outer shell (outer surface) **400** of the cartridge **4**. The cartridge **4** has a first surface **45**, a second surface **46**, a third surface **42**, a fourth surface **44**, a fifth surface **47** and a sixth surface **48**. The first to the sixth surfaces **45**, **46**, **42**, **44**, **47** and **48** constitute the outer shell (outer surface) **400** of the cartridge **4** formed by the container main body **450**. A printing material container **7** for containing ink is placed inside of the outer shell **400**. The external shape of each of the first to the sixth surfaces **45**, **46**, **42**, **44**, **47** and **48** in the planar view is an almost rectangular shape. The surface of each of the first to the sixth surfaces **45**, **46**, **42**, **44**, **47** and **48** is almost planar. The terminology "almost planar" herein includes both the state that the entire surface is perfectly flat and the state that the surface partially has some irregularities. In other words, "almost planar" includes the state that the surface is recognizable as the outer surface of the cartridge **4** even when the surface partially has slight irregularities or slight level differences. The first surface **45** is also called "front face **45**"; the second surface **46** is also called "rear face **46**"; the third surface **42** is also called "bottom face **42**"; the fourth surface **44** is also called "upper face **44**"; the fifth surface **47** is also called "first side face **47**"; and the sixth surface **48** is also called "second side face **48**".

The first surface **45** and the second surface **46** are opposed to each other in the Y-axis direction. The third surface **42** and the fourth surface **44** are opposed to each other in the Z-axis direction. The fifth surface **47** and the sixth surface **48** are opposed to each other in the X-axis direction.

As shown in FIG. **16**, the first surface **45** and the second surface **46** are opposed to each other across the printing material container **7** (internal space of the cartridge **4**). The third surface **42** and the fourth surface **44** are opposed to each other across the printing material container **7**. As shown in FIGS. **10** and **14**, the fifth surface **47** and the sixth surface **48** are opposed to each other across the printing material container **7**. As shown in FIG. **16**, the first surface **45** is located on the −Y-axis direction side of the printing material container **7**. The second surface **46** is located on the +Y-axis direction side of the printing material container **7**. The third surface **42** is located on the −Z-axis direction side of the printing material container **7**. The fourth surface **44** is located on the +Z-axis direction side of the printing material container **7**. As shown in FIGS. **10** and **14**, the fifth surface **47** is located on the +X-axis direction side of the printing material container **7**. The sixth surface **48** is located on the −X-axis direction side of the printing material container **7**. The third surface **42** intersects the first surface **45**, the second surface **46**, the fifth surface **47** and the sixth surface **48**. The fourth surface **44** intersects the first surface **45**, the second surface **46**, the fifth surface **47** and the sixth surface **48**. The fifth surface **47** intersects the first surface **45**, the second surface **46**, the third surface **42** and the fourth surface **44**. The sixth surface **48** intersects the first surface **45**, the second surface **46**, the third surface **42** and the fourth surface **44**. According to this embodiment, the terminology "intersecting" denotes any of the state that two surfaces actually cross each other, the state that an extension of one surface actually crosses the other surface, and the state that an extension of one surface actually crosses an extension of the other surface.

As shown in FIG. **16**, the first surface **45** is the surface opposed to the cartridge holder **6** in the state of attachment. The first surface **45** is almost perpendicular to the horizontal plane in the state of attachment. The third surface **42** has one-end-side face **426** and other-end-side face **423**. The one-end-side face **426** is connected with the second surface **46**. The other-end-side face **423** is connected with the first surface **45**. The one-end-side face **426** and the other-end-side face **423** are connected with each other. The other-end-side face **423** is located at a position closer to the fourth surface **44** than the one-end-side face **426** in the Z-axis direction. In other words, the other-end-side face **423** is located on the upper side (on the +Z-axis direction side) of the one-end-side face **426**.

Additionally, the cartridge **4** has a corner section **50** where the first surface **45** intersects the fourth surface **44** as shown in FIG. **10**. The corner section **50** is a recess formed across the first surface **45** and the fourth surface **44**. The corner section **50** is an area where a fourth surface **44**-side end **45***a* of the first surface **45** and a first surface **45**-side end **44***a* of the fourth surface **44** are located. A slope surface **51** connecting the first surface **45** with the fourth surface **44** is formed on the bottom of the corner section **50**. The slope surface **51** faces in a direction including a +Z-axis direction component and a −Y-axis direction component. In other words, the slope surface **51** is inclined to approach from the first surface **45** to the second surface **46** accompanied with an approach from the third surface **42** to the fourth surface **44**. The circuit board **52** is placed on the slope surface **51**. The surface **52***a* of the circuit board **52** is inclined at approximately the same angle as that of the slope surface **51**. The surface **52***a* accordingly faces in the direction including the +Z-axis direction component and the −Y-axis direction component. As shown in FIGS. **11** and **14**, a first groove **58** and a second groove **59** are formed on the respective side faces of the corner section **50**. The first groove **58** and the second groove **59** are respectively extended from the first surface **45** in the +Y-axis direction. In the process of attachment of the cartridge **4**, the member **811** (FIG. **6**) is inserted into the first groove **58** and the member **810** (FIG. **6**) is inserted into the second groove **59**. Such insertion positions the device-side terminal group **802** relative to a cartridge-side terminal group **500**.

As shown in FIGS. **12** and **13**, the circuit board **52** has the cartridge-side terminal group **500** provided on the surface **52***a* and a memory unit **520** provided on a rear face **52***b*. The surface **52***a* and the rear face **52***b* are both planes. A part (side) of the planar surface **52***a* closest to the +Z-axis direction side in the state of attachment to the cartridge **4** is called substrate end **505**.

The cartridge-side terminal group **500** is comprised of nine cartridge-side terminals **531** to **539**. The memory unit **520** stores information regarding ink in the cartridge **4** (for example, the remaining amount of ink and the color of ink to be contained). The contact between the cartridge-side terminal group **500** and the device-side terminal group **802** of the printing device **10** (FIG. **6**) causes the memory unit **520** to send and receive data signals to and from the controller **31** of the printing device **10**. The controller **31** (FIG. **1**) determines attachment of the cartridge **4** to the printing device **10**, based on the contact between the respective terminals **531** to **539** of the cartridge-side terminal group **500** and the respective terminals (nine terminals) of the device-side terminal group **802**. After such determination, the controller **31** of the printing device **10** controls the printing device **10** to be available for printing operation.

As shown in FIG. **12**, each of the nine cartridge-side terminals **531** to **539** is formed in an almost rectangular shape. Each of the nine cartridge-side terminals **531** to **539** has a contact part cp. The nine cartridge-side terminals **531** to **539** are arranged to form two rows R1 and R2. The two rows R1 and R2 are located at different heights. The two rows R1 and R2 are respectively lines extended along the width direction (Y-axis direction) in which the fifth surface **47** and the sixth surface **48** of the cartridge **4** are opposed to each other. Out of the two rows R1 and R2, the row on the −Z-axis direction side is called first terminal row R1, and the row on the +Z-axis

direction side is called second terminal row R2. The first terminal row R1 is comprised of five cartridge-side terminals **535**, **536**, **537**, **538** and **539**, and the second terminal row R2 is comprised of four cartridge-side terminals **531**, **532**, **533** and **534**. A contact portion cp that is in contact with the device-side terminal **803** of the contact mechanism **80** (FIG. **6**) is provided in a center area of each of the terminals **541** to **539**. The first terminal row R1 and the second terminal row R2 may thus be regarded as rows respectively formed by a plurality of contact portions cp.

The contact portions cp of the terminals **535** to **539** forming the first terminal row R1 and the contact portions cp of the terminals **531** to **534** forming the second terminal row R2 are arranged alternately. More specifically, the respective contact portions cp are arranged in zigzag.

Among the plurality of (five) contact portions cp forming the first terminal row R1, a contact portion located at the center of a width Wa of the plurality of (five) contact portions cp is called first contact portion **537***cp*. The terminal having the first contact portion **537***cp* is called first terminal **537**. A virtual plane that passes through the first terminal **537** and is perpendicular to the width direction (X-axis direction) is called "plane C1". The plane C1 passes through the first contact portion **537***cp*. According to the embodiment, the plane C1 passes through the center of the width of the circuit board **52** and also passes through the center of the width of the cartridge **4**. The five contact portions cp arranged on the first terminal row R1 correspond to the "plurality of contact portions" described in Solution to Problem. The plurality of contact portions cp forming the first terminal row R1 are also called "plurality of contact portions cpa", and the plurality of contact portions cp forming the second terminal row R2 are also called "plurality of contact portions cpb". The cartridge-side terminals **531** to **539** are formed in two terminal rows in this embodiment, but this is not restrictive. The cartridge-side terminals may form only the first terminal row R1 or may form only the second terminal row R2.

As shown in FIG. **12**, a boss groove **501** is formed on a +Z-axis direction side end of the circuit board **52**, and a boss hole **502** is formed on a −Z-axis direction side end of the circuit board **52**. The circuit board **52** mounted on the cartridge **4** is fixed to the slope surface **51** of the cartridge **4** (FIG. **10**) by using the boss groove **501** and the boss hole **502**. According to another embodiment, at least one of the boss groove **501** and the boss hole **502** may be omitted from the circuit board **52**, and the circuit board **52** may be fixed to the slope surface **51** by using an adhesive. Alternatively the circuit board **52** may be fixed to the slope surface **51** by using an engagement claw (not shown) provided on the slope surface **51**.

As shown in FIG. **11**, a through hole **452**, a first member through hole **458**, a second member through hole **459** and abutting portions **457** are provided on the first surface **45**. The through hole **452** receives the printing material supplier **482**. At least a supply port **480** forming one end of the printing material supplier **482** is placed in the through hole **452**. As shown in FIG. **14**, the supply port **480** is disposed at a position passing through the plane C1. The supply port **480** is in a circular shape. The center of the supply port **480** is located at the position passing through the plane C1. The supply port **480** is disposed at a position closer to the third surface **42** than the fourth surface **44** in the Z-axis direction. In other words, the supply port **480** is located in a lower area than half a height T of the cartridge **4**. In the state prior to attachment of the cartridge **4** to the cartridge holder **6** (called "initial state"), the supply port **480** may be covered with a sheet member. The sheet member has such a thickness as to be broken by the flow tube **702**.

As shown in FIG. **11**, the first member through hole **458** and the second member through hole **459** are arranged in a positional relationship across the through hole **452** in the Z-axis direction. In the state of attachment, the first positioning member **76** (FIG. **8**) is inserted into the first member through hole **458**, and the second positioning member **78** (FIG. **8**) is inserted into the second member through hole **459**. The cooperation of the pair of member through holes **458** and **459** with the pair of positioning members **76** and **78** restricts the move of the cartridge **4** in an in-plane direction perpendicular to the direction of insertion of the cartridge **4** in the course of attachment of the cartridge **4** to the cartridge holder **6**. The in-plane direction is the direction parallel to the X-axis direction and the Z-axis direction. The first member through hole **458** has a cross section perpendicular to the Y-axis direction in an almost circular shape. The second member through hole **459**, on the other hand, has a cross section perpendicular to the Y-axis direction in an elliptical shape elongated in the Z-axis direction. The length of the second member through hole **459** in the Y-axis direction is greater than the length of the second positioning member **78** in the Y-axis direction. When the second positioning member **78** is inserted into the second member through hole **459**, a small clearance is produced in the Y-axis direction. The greater length of the second member through hole **459** in the Y-axis direction facilitates the allowance for dimensional tolerance, while maintaining the accuracy of positioning. In other words, the accuracy of positioning the cartridge **4** in the slot **61** is assured by the first member through hole **458**. The positional misalignment between the second member through hole **459** and the second positioning member **78** by the dimensional tolerance or the like is absorbed by the second member through hole **459**.

There are four abutting portions **457**. The abutting portions **457** are formed in a disc shape protruded from the first surface **45**. As shown in FIG. **14**, the four abutting portions **457** are arranged around the periphery of the through hole **452**. The four abutting portions **457** are in abutment with a +Y-axis direction-side end face **703** (FIG. **5**) of the cover member **706** of the cartridge holder **6** (FIG. **8**).

As shown in FIG. **10**, a groove **445** and a cartridge-side identification member **424** are provided on the fourth surface **44**. The groove **445** is extended from the middle of the fourth surface **44** to its second surface **46**-side end. A pair of side walls **442** and **444** defining and forming the groove **445** are arranged at a predefined interval in the width direction of the cartridge **4**. More specifically, the pair of side walls **442** and **444** are arranged at such an interval that allows the pair of rail members **86** and **87** (FIG. **6**) to be inserted and fit in the groove **445**. The cartridge-side identification member **424** is formed by at least one rib (projection). The pattern of the cartridge-side identification member **424** determined by the number and the positions of ribs differs according to the type of the cartridge **4**. The cartridge-side identification member **424** is located in the Y-axis direction near a groove inlet **447** formed on a first surface **45**-side end of the groove **445**. The cartridge-side identification member **424** is also located closer to the second surface **46** than the circuit board **52**.

As shown in FIG. **11**, a groove **425** and a cartridge-side engagement structure **420** are provided on the third surface **42**. The groove **425** is extended from the middle of the third surface **42** to its second surface **46**-side end. A pair of side walls **422** and **424** defining and forming the groove **425** are arranged at a predetermined interval in the width direction of the cartridge **4**. More specifically, the pair of side walls **422**

and **424** are arranged at such an interval that allows the pair of rail members **88** and **89** (FIG. **5**) to be inserted and fit in the groove **425**. The cartridge-side engagement structure **420** is located closer to the first surface **45** than the groove **425** (groove inlet **427**). The cartridge-side engagement structure **420** is formed in a groove shape (groove structure). The cartridge-side engagement structure **420** is engaged with the device-side engagement structure **75**, so as to restrict the move of the cartridge **4** in the +Y-axis direction against the external forces Fp and Fs1 (FIG. **3**) in the direction of detachment (+Y-axis direction) applied from the cartridge holder **6**.

As shown in FIG. **19**, the cartridge-side engagement structure **420** includes a receiver portion **601**, a guide portion **606**, a connector portion **608**, an engagement portion **612** and an outlet portion **616**. In the course of attachment of the cartridge **4** to the cartridge holder **6**, the projection **74** moves in the sequence of the receiver portion **601**, the guide portion **606**, the connector portion **608** and the engagement portion **612**. In the state of attachment, the projection **74** engages with the engagement portion **612** at a specified engagement position St of the engagement portion **612**. In the course of detachment of the cartridge **4** from the cartridge holder **6**, on the contrary, the projection **74** moves in the sequence of the engagement portion **612**, the outlet portion **616** and the receiver portion **601**.

The receiver portion **601** is extended from the first surface **45** toward the second surface **46** and receives the projection **74** of the device-side engagement structure **75**. The receiver portion **601** has an opening **605** formed on the first surface **45**. The projection **74** is received into the receiver portion **601** through the opening **605**. The receiver portion **601** has a greater depth than those of the other portions **606**, **608**, **612** and **616** of the cartridge-side engagement structure **420**. While the projection **74** is located in any of the other portions **606**, **608**, **612** and **616**, the projection **74**-side of the lever body **77** is pressed down. Accordingly the cartridge **4** receives the external force Ft (FIG. **3**) in the press-up direction (+Z-axis direction **9** via the projection **74** by the elastic force of the lever body **77**.

The guide portion **606** is a portion serving to guide the projection **74** of the device-side engagement structure **75** to the engagement position St (position where the engagement portion **612** is formed). The guide portion **606** is connected with the receiver portion **601**. The guide portion **606** is extended in a direction inclined to the direction of attachment of the cartridge **4** (−Y-axis direction) in the process of attachment of the cartridge **4** to the cartridge holder **6**. More specifically, the guide portion **606** is inclined in the width direction of the cartridge **4** relative to the direction of attachment. The guide portion **606** has a slope **606***a* formed to decrease the depth of the groove with increasing distance from the receiver portion **601**. There is no step on the boundary between the guide portion **606** and the receiver portion **601**. The guide portion **606** has a length L2 in the direction in which the first surface **45** and the second surface **46** are opposed to each other (direction of attachment and direction of detachment). The length L2 is shorter than the length L1 of the printing material receiver **710** (FIG. **8**).

The connector portion **608** connects the guide portion **606** with the engagement portion **612**. The connector portion **608** has a projection wall **615** protruded in the −Y-axis direction from a +Y-axis direction-side wall defining and forming the groove. The engagement portion **612** is opposed to the projection wall **615**. The engagement portion **612** has an engagement wall **614**. The engagement wall **614** is formed by a wall portion **633**, which is one of a plurality of walls defining and forming the groove of the cartridge-side engagement structure **420**. The engagement portion **612** is formed at a position passing through the plane C1. The outlet portion **616** connects the engagement portion **612** with the receiver portion **601**. The outlet portion **616** has a slope **616***a* formed to increase the depth of the groove with decreasing distance from the receiver **601**. There is a step **620** formed on the boundary between the outlet portion **616** and the receiver portion **601**.

The following describes the move of the projection **74** in the cartridge-side engagement structure **420** during the attachment operation and the detachment operation of the cartridge **4** with reference to FIG. **19**. During the attachment operation, after the first positioning member **76** starts inserting into the first member through hole **458** (FIG. **11**) and the second positioning member **78** starts inserting into the second member through hole **459** (FIG. **11**), the projection **74** moves from the receiver portion **601** to the guide portion **606**. While the projection **74** moves along the guide portion **606**, the lever body **77** rotates in the direction including the −X-axis direction component (direction of the arrow +RB in FIG. **5**) against the pressing force of the pressing member **79** (FIG. **9**). While the projection **74** moves along the guide portion **606**, the first surface **45** (more specifically, the abutting portions **457**) of the cartridge **4** are in abutment with the end face **703** of the cover member **706** (FIG. **5**). The cartridge **4** is further pressed in the direction of attachment against the pressing force of the pressing member **712** (FIG. **8**), so that the projection **74** reaches the connector portion **608**. The projection **74** reaching the connector portion **608** moves in the direction including the +X-axis direction component (direction of the arrow −RB in FIG. **5**) by the pressing force of the pressing member **79** of the device-side engagement structure **75**. The projection **74** then hits against the projection wall **615** and stops, so that a click is produced. This click enables the user to check the sufficient advance of the cartridge **4** in the direction of attachment.

When the user's press of the cartridge **4** in the direction of attachment is released, the cartridge **4** is slightly pressed back in the direction of detachment (+Y-axis direction) by the pressing force of the pressing member **712** of the flow unit **70** (FIG. **8**). This releases the engagement by the projection wall **615** and causes the projection **74** to reach the engagement portion **612**. The projection **74** eventually hits against the engagement wall **614** of the engagement portion **612**. This restricts the move of the projection **74** in the +X-axis direction by the pressing force of the pressing member **79** (FIG. **9**). When the projection **74** hits against the engagement wall **614**, a click is produced. This click enables the user to check the reach of the cartridge **4** at the engagement position St and completion of attachment of the cartridge **4** to the cartridge holder **6**. In the state of attachment, the pressing member **712** (FIG. **8**) applies the external force Fp in the direction of detachment (+Y-axis direction) (FIG. **3**). The projection **74** is, however, in abutment with the engagement wall **614**, so as to restrict the move of the cartridge **4** in the direction of detachment.

The cartridge **4** is detached from the cartridge holder **6** by the following procedure. The user presses the cartridge **4** in the state of attachment further in the direction of attachment. The projection **74** is accordingly away from the engagement wall **614**, so as to disengage the cartridge-side engagement structure **420** from the device-side engagement structure **75**. The cartridge **4** is then moved in the direction of detachment (+Y-axis direction) by the pressing force of the pressing member **712** of the cover member **706**. The projection **74** accordingly passes through the outlet portion **616** and reaches the receiver portion **601**. The user grasps the cartridge **4** moved by a predetermined distance in the direction of detachment by

the pressing force of the pressing member **712** and detaches the cartridge **4** from the cartridge holder **6**.

A-4. Internal Structure of Cartridge

FIG. **20** is an exploded perspective view of the cartridge **4**. FIG. **21** is an exploded perspective view of a flow path unit **9**. As shown in FIG. **20**, the container main body **450** is comprised of a first container body **5***a* and a second container body **5***b*. The first container body **5***a* and the second container body **5***b* are separated from each other by disassembling. In other words, the first container body **5***a* and the second container body **5***b* are provided as separate bodies. The first container body **5***a* includes the first surface **45** but does not include the second surface **46**. The second container body **5***b* includes the second surface **46** but does not include the first surface **45**. The printing material container **7** is mainly accommodated in the second container body **5***b*. The corner section **50** is formed on the first container body **5***a*. The first container body **5***a* has projections **55** and **56** located on both ends in the Z-axis direction and protruded toward the second container body **5***b*. Part of the cartridge-side engagement structure **420** including the engagement portion **612** (FIG. **19**) is formed on the projection **55**. The projections **55** and **56** of the first container body **5***a* are fit in the second container body **5***b*, so that the first container body **5***a* and the second container body **5***b* are assembled. There is some play between the projections **55** and **56** and the second container body **5***b*. This play enables the second container body **5***b* to be slightly moved relative to the first container body **5***a*.

The printing material container **7** is provided as a bag member. Ink is filled in the printing material container **7**. The printing material container **7** is made of an aluminum-laminated multilayer film formed by stacking an aluminum layer on a resin film layer. The printing material container **7** has flexibility. The printing material container **7** is designed such that the internal volume of the printing material container **7** decreases with a decrease in remaining amount of ink in the printing material container **7**. A flow path unit **9** communicating with the inside of the printing material container **7** is mounted on a first surface **45**-side face of the printing material container **7**.

As shown in FIGS. **20** and **21**, the flow path unit **9** includes a flow path main body **90**, a valve **94** and a valve seat **92**. The flow path main body **90** and the valve seat **92** are formed by molding a synthetic resin, such as polypropylene or polystyrene. The valve **94** is made of an elastic material such as synthetic resin.

The flow path main body **90** has a printing material supplier **482** and a decompression unit **91**. The printing material supplier **482** forms a flow path to supply ink in the printing material container **7** to the printing device **10**. The front end **702***b*-side of the flow tube **702** is inserted into the printing material supplier **482**. Insertion of the flow tube **702** into the printing material supplier **482** restricts the move of the cartridge **4** to some extent in the in-plane direction perpendicular to the direction of attachment of the cartridge **4**. This accordingly positions the cartridge **4** relative to the cartridge holder **6** in the direction perpendicular to the direction of attachment. As shown in FIG. **21**, one end of the printing material supplier **482** forms the supply port **480**, and the other end forms a connecting hole **483**. The supply port **480** is open to the outside. The connecting hole **483** is located in the printing material container **7**. As shown in FIG. **20**, the printing material supplier **482** has a flow path-forming member **481** extended from a surface **95** on the first surface **45**-side of the flow path main body **90**. The flow path-forming member **481** is extended in the −Y-axis direction from the surface **95**. The flow path-forming member **481** is in a cylindrical shape. The flow path-forming member **481** is a one-end-side section of the printing material supplier **482** including the supply port **480**. A center axis CB of the flow path-forming member **481** is extended along the Y-axis direction. A one-end-side flow path including the supply port **480** in the flow path of the printing material supplier **482** is formed by the flow path-forming member **481**. In other words, the internal flow path in the one-end-side section of the printing material supplier **482** including the supply port **480** is extended along the Y-axis direction.

A valve unit (not shown) is placed in the flow path-forming member **481**. The valve unit includes a valve and a valve seat with a valve hole. The valve seat is made of an elastic material such as synthetic rubber. Insertion of the flow tube **702** into the printing material supplier **482** through the supply port **480** causes the valve to be separated from the valve seat. The valve unit is accordingly set in the valve-opening position to open the internal flow path of the printing material supplier **482**. The outer circumference of the flow tube **702** is air-tightly surrounded by the valve seat. Insertion of the flow tube **702** into the printing material supplier **482** positions the cartridge **4** relative to the cartridge holder **6**. more specifically, this positions the cartridge **4** in the in-plane direction perpendicular to the direction of attachment of the cartridge **4**. According to this embodiment, in the state of attachment, the outer circumference of the flow tube **702** is air-tightly surrounded by the valve seat. Any other suitable technique may, however, be employed to prevent ink from being externally leaked from the clearance between the flow tube **702** and the printing material supplier **482**. For example, the flow tube **702** may be inserted and fit in the printing material supplier **482**. In other words, the inner circumference of the printing material supplier **482** may be in contact with the entire outer circumference of the flow tube **702** in the circumferential direction.

As shown in FIGS. **20** and **21**, the valve seat **92** has a valve hole **93** which ink flows through. When the ink flows from the printing material container **7** to the printing device **10**, the valve **94** is separated from the valve seat **92**. The valve **94** is accordingly set in the valve-opening position to allow the ink to flow through the printing material supplier **482**. The ink flowing through the printing material supplier **482** then flows into the printing device **10**. When there is a reverse ink flow back to the printing material container **7**, the valve **94** is seated on the valve seat **92** to block the valve hole **93**, so as to interfere with the back flow of ink. As described above, the printing material supplier **482** connects the printing material container **7** with the printing device **10**.

The decompression unit **91** is used to reduce the internal pressure of the printing material container **7**, when the printing material container **7** is filled with ink. One end **91***a* of the decompression unit **91** is open to the outside. The other end **91***b* of the decompression unit **91** is open in the printing material container **7**. Before the printing material container **7** is filled with ink, the decompression unit **91** is actuated to externally reduce the pressure of the printing material container **7**. After decompression, ink is flowed through the printing material supplier **482** into the printing material container **7**. The flow path of the decompression unit **91** is blocked by, for example, thermal welding, after the printing material container **7** is filled with ink.

A-5. Attachment Process of Cartridge

The following describes the process of attachment of the cartridge **4** to the cartridge holder **6** with reference to FIGS. **22**

to **24**. FIG. **22** is a first explanatory diagram; FIG. **23** is a second explanatory diagram; and FIG. **24** is a third explanatory diagram. The operation of attachment of the cartridge **4** to the cartridge holder **6** proceeds in the sequence of FIG. **22**, FIG. **23** and FIG. **24**. FIG. **22** is the diagram at the time when insertion of the first positioning member **76** into the first member through hole **458** and insertion of the second positioning member **78** into the second member through hole **459** are started (called "first time"). FIG. **23** is the diagram at the time when the cartridge-side identification member **424** reaches the device-side identification member **82** (called "second time"). In other words, FIG. **23** is the diagram at the time when fitting between the cartridge-side identification member **424** and the device-side identification member **82** is started. FIG. **24** is the diagram at the time when the cartridge **4** is attached to the cartridge holder **6** (called "third time"). FIG. **24** is accordingly the F2-F2 cross sectional view in the state of attachment.

As shown in FIG. **22**, at the first time, fitting between the device-side identification member **82** and the cartridge-side identification member **424** has not yet been started. At the first time, the cover member **706** is not in contact with but is separated from the cartridge **4**. At the first time, the printing material supplier **482** and the flow tube **702** are away from each other in the Y-axis direction by a distance DA. At the first time, the cartridge-side identification member **424** and the device-side identification member **82** are away from each other in the Y-axis direction by a distance DB. At the first time, the printing material supply system **1** has the relationship of the distance DA>the distance DB. At the first time, the supply port **480** is located on the upper side (immediately above, on the fourth surface **44**-side, +Z-axis direction side) of the printing material receiver **710**. In other words, the supply port **480** and the third surface **42** have the positional relationship across the printing material receiver **710** in the Z-axis direction. The first time is the time prior to engagement of the device-side engagement structure **75** with the cartridge-side engagement structure **420**. At the first time, the projection **74** of the device-side engagement structure **75** is located in the receiver portion **601**.

As shown in FIG. **23**, at the second time, the first surface **45** of the cartridge **4** is in abutment with the cover member **706**, so as to apply a force in the −Y-axis direction (direction of attachment) to the cover member **706**. The cover member **706** accordingly moves in the −Y-axis direction against the pressing force of the pressing member **712**. The flow tube **702** is inserted into the printing material supplier **482** during the period from the second time to the third time. More specifically, the flow tube **702** is inserted into the printing material supplier **482**, before the device-side terminals **803** come into contact with the contact portions cp of the circuit board **52**.

As shown in FIG. **24**, at the third time, the device-side terminals **803** are in contact with the contact portions cp of the circuit board **52**. A the third time, the flow tube **702** is inserted into the printing material supplier **482** to allow for the ink flow from the printing material supplier **482** into the flow tube **702**. More specifically, after insertion of the flow tube **702** into the printing material supplier **482**, the device-side terminals **803** come into contact with the contact portions cp of the circuit board **52**. At the third time, the projection **74** of the device-side engagement structure **75** engages with the engagement portion **612** of the cartridge-side engagement structure **420**. The engagement portion **612** is a portion to be engaged with the device-side engagement structure **75**.

As described above, the respective components of the printing material supply system **1** have the following relationships in the process of attachment of the cartridge **4** to the cartridge holder **6**. After insertion of the pair of positioning members **76** and **78** into the pair of member through holes **458** and **459** is started, fitting between the device-side identification member **82** and the cartridge-side identification member **424** is started. After fitting between the device-side identification member **82** and the cartridge-side identification member **424** is started, the flow tube **702** is inserted into the printing material supplier **482**. After the insertion of the flow tube **702** into the printing material supplier **482** allows for the ink flow from the printing material supplier **482** to the flow tube **702**, the device-side terminals **803** come into contact with the contact portions cp of the circuit board **52**.

A-6. Advantageous Effects

FIG. **25** is a first diagram illustrating the advantageous effects. FIG. **26** is a second diagram illustrating the advantageous effects. FIG. **25** shows an example of a cartridge **4***p* having a contact surface **529***p* which is not inclined to a fourth surface **44***p* but forms a horizontal plane. FIG. **25** schematically illustrates part of the forces applied from a cartridge holder to the cartridge **4***p* in the state of attachment of the cartridge **4***p*. FIG. **26** schematically illustrates part of the forces applied from the cartridge holder **6** to the cartridge **4** of the embodiment in the state of attachment. FIGS. **25** and **26** illustrate the forces having components in the clamping direction of the cartridge **4** or **4***p* along the Z-axis direction.

As shown in FIGS. **25** and **26**, forces Fs and Fd applied from the device-side terminals **803** to the contact portions cp arranged on the surface **52***a* of the circuit board **52** are respectively set to have predetermined angles relative to the contact surfaces **529** and **529***p*. In FIGS. **25** and **26**, the external forces Fs and Fd are both almost perpendicular to the contact surfaces **529** and **529***p*. The external forces Fs and Fd have the same magnitude. External forces Ft and Ftd are respectively applied from the projection **74** of the device-side engagement structure **75** to the third surface **42**. The directions of the external forces Ft and Ftd are respectively almost vertically upward direction.

As shown in FIG. **25**, the contact surface **529***p* is not inclined to the fourth surface **44***p*. In this case, the forces applied in the direction perpendicular to the direction of detachment and applied in the clamping direction of the cartridge **4***p* are the forces Fd and Ftd. The force Fd and the force Ftd have the same magnitude, so that the forces applied in the vertical direction of the cartridge **4***p* (Z-axis direction) are balanced.

As shown in FIG. **26**, the contact surface **529** is inclined to the fourth surface **44** along the predefined direction. In this case, the force Fs is resolved into a force component Fs2 in the vertically downward direction and a force component Fs1 in the direction of detachment. The vertically downward direction is the direction from the fourth surface **44** to the third surface **42**. The direction of detachment is the direction from the first surface **45** to the second surface **46**. The force component Fs2 and the force Ft have the same magnitude, so that the forces applied in the vertical direction of the cartridge **4** (Z-axis direction) are balanced. Since Fs=Fd, the following relationships are satisfied: Fs2<Fd and Ft<Ftd.

As described above, according to this embodiment, the contact surface **529** is inclined to the fourth surface **44** along the predefined direction. Such inclination of the contact surface **529** reduces the force Fs2 in the clamping direction of the cartridge **4** (−Z-axis direction) out of the force Fs applied to the contact portions cp in the state of attachment, compared with the contact surface **529***p* without inclination. This enables the cartridge **4** to be readily detached from the car-

tridge holder **6**. For example, when the cartridge-side engagement structure **420** is disengaged from the device-side engagement structure **75**, the cartridge **4** is enabled to be smoothly moved in the direction of detachment by the pressing force produced by the pressing member **712** of the cover member **706** (FIG. **8**). More specifically, the cartridge **4** is enabled to be moved in the direction of detachment to such an extent that the contact portions cp are sufficiently away from the device-side terminals **803** by the pressing force of the pressing member **712**. This enables the user to detach the cartridge **4** from the cartridge holder **6**.

Since the contact surface **529** is inclined to the fourth surface **44** along the predefined direction, the force Fs applied to the contact portions cp has the force component Fs1 in the direction of attachment. This enables the cartridge **4** to be more readily detached from the cartridge holder **6**. For example, in the state immediately after disengagement of the cartridge-side engagement structure **420** from the device-side engagement structure **75**, the pressing force Fp of the pressing member **712** (FIG. **3**) and the force component Fs1 are applied in the direction of detachment of the cartridge **4**. This increases the force applied in the direction of detachment and enables the cartridge **4** to be more smoothly moved in the direction of detachment.

The force Ft balances with the force component Fs2 and is thereby made smaller corresponding to the smaller force component Fs2. This reduces the force Ft applied in almost vertically upward direction from the device-side engagement structure **75** to the cartridge **4**.

According to the above embodiment, the engagement portion **612** of the cartridge **4** is located at the position passing through the first terminal **537** and passing through the plane C1 perpendicular to the width direction (FIG. **19**). Engagement of the engagement portion **612** with the projection **74** restricts the move of the cartridge **4** in the direction of detachment (+Y-axis direction). More specifically, the engagement portion **612** serves to position the cartridge **4** relative to the cartridge holder **6** to some extent. Locating the engagement portion **612** at the position passing through the plane C1 enables the plurality of terminals **535** to **539** forming the first terminal row R1 to be positioned relative to the cartridge holder **6** with high accuracy. The plurality of terminals **531** to **534** forming the second terminal row R2 has a certain positional relationship to the plurality of terminals **535** to **539** forming the first terminal row R1. This accordingly enables all the terminals **531** to **539** of the cartridge **4** to be positioned to the cartridge holder **6** with high accuracy. This reduces the likelihood of contact failure (poor electrical continuity) between the cartridge-side terminal group **500** and the device-side terminal group **802**.

In the state of attachment, the unbalance of the external force in the clamping direction of the cartridge **4** may cause the cartridge **4** to be tilted or rotated from the correct attitude of attachment. The tilt or rotation of the cartridge **4** from the correct attitude of attachment may make it difficult to detach the cartridge **4** from the cartridge holder **6**. The tilt or rotation of the cartridge **4** from the correct attitude of attachment may also cause a contact failure between the contact portions cp and the printing device **10** (more specifically, device-side terminals **803**). According to this embodiment, since the engagement portion **612** is located at the position passing through the plane C1, the cartridge **4** is clamped by the engagement portion **612** and the first terminal **537** on the plane C1. More specifically, in the state of attachment, the cartridge **4** is clamped by the force applied to the engagement portion **612** by the projection **74** and the force applied to the first terminal **537** by the device-side terminal **803**. This suppresses the cartridge **4** from being tilted or rotated from the correct attitude of attachment. This accordingly enables the cartridge **4** to be readily detached from the cartridge holder **6** and reduces the likelihood of a contact failure between the contact portions cp and the device-side terminals **803**.

According to the above embodiment, the first contact portion **537***cp* of the first terminal **537** is located at the position passing through the plane C1 (FIG. **12**). The first contact portion **537***cp* is a portion where the cartridge-side terminal group **500** is actually in contact with the device-side terminal group **802**. The first contact portion **537***cp* is located at the center of the width Wa of the plurality of contact portions cpa arrayed along the width direction of the cartridge **4** (X-axis direction) (FIG. **12**). The arrangement of the first contact portion **537***cp* passing through the plane C1 enables the plurality of terminals **535** to **539** forming the first terminal row R1 to be positioned relative to the cartridge holder **6** with the higher accuracy. This accordingly enables all the terminals **531** to **539** of the cartridge **4** to be positioned relative to the cartridge holder **6** with the higher accuracy. This further reduces the likelihood of a contact failure between the cartridge-side terminal group **500** and the device-side terminal group **802**.

Insertion of the flow tube **702** into the printing material supplier **82** also serves to position the cartridge **4** relative to the cartridge holder **6**. According to the above embodiment, the supply port **480** of the cartridge **4** is located at the position passing through the plane C1 (FIG. **14**). This arrangement of the above embodiment enables the plurality of terminals **535** to **539** forming the first terminal row R1 to be positioned relative to the cartridge holder **6** with the higher accuracy. In other words, this enables all the terminals **531** to **539** of the cartridge **4** to be positioned relative to the cartridge holder **6** with the higher accuracy. This further reduces the likelihood of a contact failure between the cartridge-side terminal group **500** and the device-side terminal group **802**.

The supply port **480** serves to position the cartridge **4** to the printing device **10** with the high accuracy and thereby enables the engagement portion **612** and the first terminal **537** passing through the plane C1 to be arranged at the designed positions with high accuracy in the state of attachment. This enables the cartridge **4** to be stably clamped using the engagement portion **612** and the first terminal **537**. Suppression of the rotation or tilt of the cartridge **4** facilitates detachment of the cartridge **4** from the printing device **10**.

According to the above embodiment, the supply port **480** is located closer to the third face **42** rather than to the fourth face **44** (FIG. **14**). This locates the supply port **480** at a distance from the contact portions cp arranged on the corner section **50** where the first surface **45** intersects the fourth surface **44** and thereby reduces the likelihood that the contact portions cp are stained with ink even in the event of leakage of ink from the supply port **480**. This accordingly ensures the good contact between the contact portions cp and the printing device **10** (more specifically, the device-side terminal group **802**).

According to the above embodiment, the cartridge-side engagement structure **420** is formed on the other-end-side face **423** of the third surface **42** (FIG. **16**). The other-end-side face **423** is located at the position closer to the fourth surface **44** than the one-end-side face **426**. In other words, the other-end-side face **423** is located on the vertically upper side (+Z-axis direction side) of the one-end-side face **426**. This arrangement reduces the first surface **45**-side dimension of the cartridge **4** in the direction in which the third surface **42** and the fourth surface **44** are opposed to each other (Z-axis direction). The printing material container **7** of the cartridge **4** is located closer to the second surface **46**-side of the container

main body **450** than the first surface **45**-side (FIG. **16**). The second surface **46**-side of the container main body **450** is longer in the Z-axis direction than the first surface **45**-side of the container main body **450**. This arrangement provides the sufficient internal volume and thereby ensures the sufficient capacity of the printing material container **7**. Reduction of the first surface **45**-side dimension where the cartridge-side engagement structure **420** of the cartridge **4** is located ensures the sufficient space where the device-side engagement structure **75** of the cartridge holder **6** is located. This enhances the flexibility of design of the device-side engagement structure **75**. For example, this reduces the likelihood that elastic deformation of the device-side engagement structure **75** in the direction RC (FIG. **8**) is extremely limited. In another example, this ensures the sufficient space where the components of the device-side engagement structure **75** (lever member **73** and pressing member **79**).

According to the above embodiment, the supply port **480** is located on the upper side of (immediately above) the printing material receiver **710** during the period from the time prior to engagement of the cartridge-side engagement structure **420** with the device-side engagement structure **75** (first time in FIG. **22**) to the time of engagement (third time in FIG. **24**). In other words, at the first time, the supply port **480** and the third surface **42** are arranged at the positional relationship across the printing material receiver **710**. Even in the event of leakage of ink from the supply port **480** downward (to the third surface **42**-side) in the course of attachment or detachment of the cartridge **4** to or from the cartridge holder **6**, this positional relationship ensures the ink to be trapped by the printing material receiver **710**. Trapping the ink reduces the likelihood of ink splash from the supply port **480** over a wide area.

According to the above embodiment, at the first time, the projection **74** of the device-side engagement structure **75** is located in the receiver portion **601** (FIG. **22**). At the first time, the supply port **480** is located above the printing material receiver **710** (FIG. **22**). More specifically, in the course of attachment of the cartridge **4** to the cartridge holder **6**, the supply port **480** is located on the upper side of (immediately above) the printing material receiver **710**, while the projection **74** of the device-side engagement structure **75** is located at the guide portion **606**. Even in the event of leakage of ink from the supply port **480** downward (toward the third surface **42**-side), this arrangement reduces the likelihood of ink splash from the supply port **480** over a wide area, at least while the projection **74** is located at the guide portion **606**.

According to the above embodiment, the second container body **5***b* is removably attached to the first container body **5***a* (FIG. **20**). The cartridge-side engagement structure **420** is formed on the first container body **5***a* which is located on the direction-of-attachment side (−Y-axis direction side) of the second container body **5***b*. There may be the state that the cartridge-side engagement structure **420** is not disengaged from the device-side engagement structure **75** by the operation of releasing the engagement of the cartridge-side engagement structure **420** with the device-side engagement structure **75** (state of failure). In this case, the user can readily check the state of engagement on the first container body **5***a*-side by simply detaching the second container body **5***b* from the first container body **5***a*. The user can thus readily check the reason for the state of failure. Identification of the reason for the state of failure improves the likelihood that the user eliminates the state of failure.

The printing material container **7** is mainly accommodated in the second container body **5***b*, so that the second container body **5***b*-side is heavier than the first container body **5***a*-side. In the state of attachment, the second container body **5***b*-side is likely to be affected by the gravity and tends to be tilted vertically downward by the gravity. The second container body **5***b* may also be rattled by an external force. According to the above embodiment, the cartridge-side engagement structure **420** and the contact portions cp are arranged on the first container body **5***a*-side of the container main body **450** (FIGS. **10**, **12** and **20**). The cartridge **4** is clamped by the force applied from the printing device **10** to the cartridge-side engagement structure **420** and the contact portions cp, so that the position of attachment of the first container body **5***a*-side is stabilized. Even when the second container body **5***b* is displaced by, for example, rattling, this reduces the likelihood that the first container body **5***a* where the cartridge-side engagement structure **420** is located is shifted from the designed position of attachment and thereby suppresses a contact failure between the contact portions cp and the printing device **10** (more specifically, the device-side terminals **803**). According to the above embodiment, there is some play between the projections **55** and **56** and the second container body **5***b*. The presence of such play further reduces the likelihood that the first container body **5***a* is shifted from the designed position of attachment even when the second container body **5***b* is displaced by, for example, rattling. This further suppresses a contact failure between the contact portions cp and the printing device **10** (more specifically, the device-side terminals **803**). The presence of the play also further suppresses the entire cartridge **4** from being tilted or rotated from the correct attitude of attachment.

According to the above embodiment, part of the cartridge-side engagement structure **420** including the engagement portion **612** is formed on the projection **55** (FIG. **20**). The projection **55** is located on the direction-of-detachment side of the first container body **5***a*. The user can thus readily check the reason for the state of failure by simply detaching the second container body **5***b* from the first container body **5***a*. This further improves the likelihood that the user eliminates the state of failure.

The printing material container **7** is mainly accommodated in the second container body **5***b*, so that the second container body **5***b*-side is heavier than the first container body **5***a*-side. In the state of attachment, the second container body **5***b*-side is likely to be affected by the gravity and tends to be tilted vertically downward by the gravity. The second container body **5***b* may also be rattled by an external force. According to the embodiment, however, there is some play between the projections **55** and **56** and the second container body **5***b*. The presence of such play further reduces the likelihood that the first container body **5***a* is shifted from the designed position of attachment even when the second container body **5***b* is displaced by, for example, rattling. This further suppresses a contact failure between the contact portions cp and the printing device **10** (more specifically, the device-side terminals **803**). The presence of the play also further suppresses the entire cartridge **4** from being tilted or rotated from the correct attitude of attachment. There is a need that at least one of the two projections **55** and **56** has such play.

According to the above embodiment, the respective components of the printing material supply system **1** have the following relationships during attachment of the cartridge **4** to the cartridge holder **6**.

First Relationship

As shown in FIGS. **22** and **23**, after insertion of the pair of positioning members **76** and **78** into the pair of member through holes **458** and **459** is started, fitting between the device-side identification member **82** and the cartridge-side identification member **424** is started (first relationship). Insertion of the pair of positioning members **76** and **78** into the pair

of member through holes **458** and **459** limits the move of the cartridge **4** in the in-plane direction perpendicular to the direction of insertion of the cartridge **4**. This causes the cartridge **4** to be positioned relative to the cartridge holder **6** in the direction perpendicular to the direction of insertion and thereby suppresses the positional misalignment of the cartridge-side identification member **424** relative to the device-side identification member **82**. This reduces the likelihood that the cartridge-side identification member **424** hits against the device-side identification member **82** to interfere with their fitting in the case that a correct type of cartridge **4** is attached to the cartridge holder **6**. In the case that a wrong type of cartridge **4** is intended to be attached to the cartridge holder **6**, the cartridge-side identification member **424** effectively hits against the device-side identification member **82** to interfere with further insertion of the cartridge **4**. This accordingly reduces the likelihood that any wrong type of cartridge **4** is set in each of the slots **61***a* to **61***d* of the cartridge holder **6**.

Second Relationship

As shown in FIGS. **23** and **24**, after fitting between the device-side identification member **82** and the cartridge-side identification member **424** starts, the flow tube **702** is inserted into the printing material supplier **482** (second relationship). This reduces the likelihood that ink is supplied from the cartridge **4** to the printing device **10** in the state that a wrong type of cartridge **4** is set in each of the slots **61***a* to **61***d* of the cartridge holder **6**.

Third Relationship

As shown in FIGS. **23** and **24**, after the ink flow from the printing material supplier **482** to the flow tube **702** is enabled by insertion of the flow tube **702** into the printing material supplier **482**, the device-side terminals **803** come into contact with the contact portions cp of the circuit board **52**. This prevents the printing device **10** from starting a printing operation in the state before the ink flow from the printing material supplier **482** to the flow tube **702** is enabled. This accordingly prevents an idling operation which is an operation of ejecting the air from the head **22**.

According to the above embodiment, the abutting portions **457** provided on the first surface **45** are in abutment with the end face **703** of the cover member **706** (FIG. **23**). The accuracy of the timing when the cartridge **4** is in abutment with the cover member **706** is improved by producing the abutting portions **457** with high accuracy instead of increasing the accuracy of production of the entire first surface **45**.

B. Second Embodiment

B-1. Details of Printing Material Container 7*a*

FIG. **27** is a first diagram illustrating a printing material container **7***a* according to a second embodiment. FIG. **28** is an F27-F27 cross sectional view of FIG. **27**. FIG. **27** schematically illustrates the printing material container **7***a* cut by a plane parallel to the Y-axis direction and the Z-axis direction. In order to facilitate understanding, the flow unit **9** is also schematically illustrated. A cartridge **4***a* of the second embodiment differs from the cartridge **4** of the first embodiment by the structure of the printing material container **7***a*. Otherwise the structure of the cartridge **4***a* is identical with the structure of the cartridge **4** of the first embodiment. The like components are expressed by the like numerical symbols and are not specifically explained here. A printing device which the cartridge **4***a* of the second embodiment is attached to has the same structure as that of the printing device **10** of the first embodiment. The printing material container **7** of the first embodiment does not have a second sealing part **705** described below.

As shown in FIG. **28**, the printing material container **7***a* is comprised of first and second sheet members **732** and **734** forming the outer shell. The first and the second sheet members **732** and **734** are made of an aluminum-laminated multilayer film formed by stacking an aluminum layer on a resin film layer. As shown in FIG. **27**, the printing material container **7***a* has a first sealing part **704** and a second sealing part **705**. As shown in FIG. **28**, the first sealing part **704** is a portion where the outer peripheries of the two sheet members **732** and **734** are welded to each other. The second sealing part **705** is a portion where specified regions of the two sheet members **732** and **734** are inserted from both sides in the X-axis direction and are welded to each other. The second sealing part **705** is formed along a direction perpendicular to the center axis CB of the flow path-forming member **481**. The inner space of the printing material container **7***a* is accordingly parted into a first chamber **720** and a second chamber **722**. The first chamber **720** is filled with ink. The second chamber **722** is a closed space without being filled with ink. The first chamber **720** communicates with the printing material supplier **482**.

The printing material container **7***a* may be produced, for example, by the following procedure. The procedure first welds the outer peripheries of the first and the second sheet members **732** and **734** to each other. During this welding process, the flow unit **9** is attached to respective one side faces of the first and the second sheet members **732** and **734**. The procedure then inserts specified regions of the first and the second sheet members **732** and **734**, which are away from the flow unit **9** in the +Y-axis direction, and welds the specified regions to each other, so as to form the second sealing part **705**. The procedure subsequently uses the flow unit **9** to fill the first chamber **720** with ink.

According to the above second embodiment, the printing material container **7***a* has the first chamber **720** which is filled with ink and the second chamber **722** which is the closed space without being filled with ink. The amount of ink injected into the printing material container **7***a* may differ by the type of the cartridge **4***a* (ink color or type of printing device used). In such cases, plural different types of printing material containers **7***a* containing different amounts of inks are formed from the common first and second sheet members **732** and **734** by simply changing the position of the second sealing part **705**. This reduces the manufacturing cost of the cartridge **4***a*. Inks is injected into the first chamber **720** after formation of the second sealing part **705**, so that so ink is injected into the second sealing part **705**. This reduces the amount of ink that is not used for printing (remaining amount of ink).

In general, ink adheres to the inner surfaces of the first and the second sheet members **732** and **734**. The adhering ink is not used for printing but remains in the printing material container **7***a*. When a small amount of ink is injected into the printing material container **7***a* without formation of the second sealing part **705**, there is a high ratio of the amount of ink adhering to the inner surfaces of the first and the second sheet members **732** and **734** to the injected amount of ink. In other words, this increases the ratio of the amount of ink not used for printing. Formation of the second sealing part **705** in the printing material container **7***a*, on the other hand, reduces the contact area of the first and the second sheet members **732** and **734** that are exposed to ink. This reduces the ratio of the amount of ink adhering to the inner surfaces of the first and the second sheet members **732** and **734** to the injected amount of ink.

B-2. Modification of Second Embodiment

FIG. **29** is a diagram illustrating a modification of the second embodiment. A printing material container **7***b* of a cartridge **4***b* shown in FIG. **29** differs from the printing material container **7***a* of the second embodiment by the position where a second sealing part **705***b* is formed. Otherwise the structure of the cartridge **4***b* is identical with the structure of the cartridge **4***a* of the second embodiment. The like components are expressed by the like numerical symbols and are not specifically explained here. As shown in FIG. **29**, the second sealing member **705***b* may be formed along the center axis CB. This arrangement has the similar advantageous effects to those of the second embodiment: for example, this reduces the production cost of the cartridge **4***b*. The second sealing part **705***b* may alternatively be formed along a direction inclined to the center axis CB.

C. Modifications

The invention is not limited to the above aspects or embodiments but may be implemented by various other aspects without departing from the scope of the invention. Some of possible modifications are given below.

C-1. Modifications with Regard to Contact Surface of Cartridge

FIGS. **30** and **31**A conceptually illustrate modifications with regard to the contact surface of the cartridge. Cartridges **4***c* and **4***d* respectively shown in FIGS. **30** and **31**A differ from the cartridge **4** of the first embodiment by the mounting structure of the circuit board **52**. Otherwise the structure of the cartridge and the structure of the printing device **10** are identical with those of the first embodiment. Like components to those of the first embodiment are expressed by like numerical symbols and are not specifically described here.

The cartridge **4***c* shown in FIG. **30** has the circuit board **52** of movable structure. More specifically, a mounting portion **527** is provided on one side face of the circuit board **52** to mount the circuit board **52** on the slope surface **51**. The circuit board **52** is movable about the mounting portion **527** as the axis of rotation. In the state of attachment of the cartridge **4***c*, the contact surface **529** is formed, like the first embodiment.

The cartridge **4***d* shown in FIG. **31**A has the circuit board **52** mounted on the slope surface **51** by means of a spring **600**. In the state of attachment of the cartridge **4***d*, the contact surface **529** is formed, like the first embodiment.

In the description hereof, the term "plane" is used in a sense including both a virtual plane (non-real plane) and a real plane. Accordingly, the contact surface **529** defined by three or more contact portions including the contact portions cpa forming the first terminal row R1 and the contact portions cpb forming the second terminal row R2 includes both a virtual plane inclined in a predefined direction and a real plane inclined in the predefined direction.

FIG. **31**B is a diagram illustrating one example of the virtual contact surface **529** inclined in the predefined direction. FIG. **31**C is a diagram viewed from the −X-axis direction. FIG. **31**B illustrates one example of the circuit board **52** having a step S between the first terminal row R1 and the second terminal row R2. In this illustrated example, a virtual contact surface **529** is defined by connecting a contact portion **534***cp* of a terminal **534** included in a first terminal row R1 with contact portions **538***cp* and **539***cp* of terminals **538** and **539** included in a second terminal row R2. As shown in FIG. **31**C, the virtual contact surface **529** defined by the respective contact portions **534***cp*, **538***cp* and **539***cp* is inclined in the predefined direction.

FIG. **31**D is a diagram illustrating another example of the virtual contact surface **529** inclined in the predefined direction. The circuit board **52** shown in FIG. **31**D is made of a bendable (flexible) film. Since the circuit board **52** is bendable, a virtual contact surface **529** is inclined in the predefined direction without formation of the step S shown in FIGS. **31**B and **31**C.

As described above, the inclined surface formed by the contact portions cp (including both the virtual contact surface **529** and the real contact surface **529**) needs to be inclined to the fourth surface **44** in the predefined direction in at least the state of attachment. In any structure other than those described above, inclination of the virtual or real contact surface **529** enables the cartridge **4** to be more readily detached from the cartridge holder **6**.

C-2. Modifications with Regard to Shape of Cartridge

FIGS. **32** and **33** conceptually illustrate modifications with regard to the shape of the cartridge. Cartridges **4***e* and **4***f* shown in FIGS. **32** and **33** differ from the cartridge **4** of the first embodiment by the external shape of the cartridge. Otherwise the structure of the cartridge and the structure of the printing device **10** are identical with those of the first embodiment. Like components to those of the first embodiment are expressed by like numerical symbols and are not specifically described here.

The outer shell of the cartridge **4***e* shown in FIG. **32** has an almost elliptical or almost oval side face. The cartridge **4***e* has a supply port **480** and first and second member through holes **458** and **459** on the first surface **45**-side, a cartridge-side engagement structure **420** on the third surface **42**-side, and a circuit board **52** on the corner section **50**. When viewed from the first surface **45**-side, this cartridge **4***e* has a fixed width. This cartridge **4***e* provided with the components (for example, the cartridge-side engagement structure **420**) corresponding to the respective components of the cartridge holder **6** (for example, the device-side engagement structure **75**) is compatible with the cartridge **4** of the first embodiment.

In the cartridge **4***f* shown in FIG. **33**, the first container body **5***a* of the members constituting the outer shell is identical with that of the first embodiment. This cartridge **4***f* includes a second container body **5***b* of the outer shell in a curved shape. The cartridge **4***f* has a supply port **480** and first and second member through holes **458** and **459** on the first surface **45**-side, a cartridge-side engagement structure **420** on the third surface **42**-side, and a circuit board **52** on the corner section **50**. When viewed from the first surface **45**-side, this cartridge **4***f* also has a fixed width. This cartridge **4***f* provided with the components (for example, the cartridge-side engagement structure **420**) corresponding to the respective components of the cartridge holder **6** (for example, the device-side engagement structure **75**) is also compatible with the cartridge **4** of the first embodiment.

The external shape of the cartridge may have various modifications as shown in FIGS. **32** and **33**. Even when the cartridge has an external shape other than almost rectangular parallelepiped, six surfaces of the almost rectangular parallelepiped, i.e., the first surface **45**, the second surface **46**, the third surface **42**, the fourth surface **44**, the fifth surface **47** and the sixth surface **48**, may be virtually assumed, for example, as shown by the dotted lines and the solid lines in FIG. **32** or FIG. **33**. In the description hereof, the term "plane" is used in

a sense including both such a virtual plane (non-real plane) and a real plane described in FIGS. **10** and **11**. The term "plane" is also used in a sense including both a flat surface and a curved surface.

C-3. Modifications of Cartridge-Side Terminal Group

FIGS. **34** to **36** are diagrams illustrating modifications with regard to the shape of the terminals on the circuit board. These circuit boards **52***g* to **52***i* differ from the circuit board **52** shown in FIG. **12** only by the surface shape of the cartridge-side terminals **431** to **539**. In the circuit boards **52***g* and **52***h* of FIGS. **34** and **35**, the individual terminals are not in almost rectangular shape but in irregular shape. In the circuit board **52***i* of FIG. **36**, the nine terminals **531** to **529** are arranged in one array. In these circuit boards **52***g* to **52***i*, the arrangement of the contact portions cp of the respective terminals **531** to **539** to be in contact with the device-side terminals is similar to that in the circuit board **52** shown in FIG. **12**. As described above, as long as the contact portions cp maintain the same arrangement, the surface shape of the individual terminals may be modified in various ways.

D. Other Modifications

D-1. First Modification

The printing material container **7** is provided as the bag member in the above embodiment, but this is not restrictive. The printing material container **7** may be in any form to contain ink. For example, the printing material container **7** may be formed by the first and second container bodies **5***a* and **5***b* constituting the outer shell of the cartridge **4**.

D-2. Second Modification

FIG. **37** is a diagram illustrating a second modification. A cartridge **4***j* shown in FIG. **37** includes a mounting member **904**, a container member **900** and a connector member **902**. The mounting member **904** has the same structure as that of the cartridge **4** of the first embodiment. The container member **900** is provided as a tank to contain ink therein. The connector member **902** is provided as a hose of connecting the container member **900** with the printing material container **7**. The connector member **902** passes through the second surface **46** to be connected with the printing material container **7**. The container member **900** is located, for example, outside of the printing device **10**. When ink is consumed by the printing device **10**, ink is refilled from the container member **900** into the printing material container **7**. When ink in the container member **900** is used up, the user may replace the container member **900** or refill ink into the container member **900**.

D-3. Third Modification

FIG. **38** is a diagram illustrating a third modification. A cartridge **4***k* shown in FIG. **38** includes a first container body **5***a* and a supply unit **910**. The first container body **5***a* is identical with the first container body **5***a* of the first embodiment (FIG. **20**). The first container **5***a* has components, such as a circuit board **52** (not shown) and a through hole **452**, corresponding to the respective components of the cartridge holder **6** (for example, the device-side terminal group **802**). The supply unit **910** has the printing material supplier **482** which the flow tube **702** is inserted in. The supply unit **910** includes a supply member **914** as a printing material supplier, a connector member **912** and a container member **911**. The flow tube **702** is inserted into the supply member **914**. The supply member **914** has the same structure as that of the flow path-forming member **481** of the first embodiment (FIG. **20**). The container member **911** is provided as a tank to contain ink therein. The connector member **912** is provided as a hose of connecting the container member **911** with the supply member **914**. The container member **911** is located, for example, outside of the printing device **10**. When ink is consumed by the printing device **10**, ink is directly supplied from the container member **911** through the supply member **914** to the printing device **10**. When ink in the container member **911** is used up, the user may replace the container member **911** or refill ink into the container member **911**.

D-4. Fourth Modification

The present invention is not limited to the inkjet printer or its ink cartridge but is also applicable to any printing device (fluid ejection device) that ejects a fluid other than ink and a cartridge (fluid container) used to contain the fluid. For example, the invention is applicable to a variety of fluid ejection devices and their fluid containers:

(1) image recording devices, such as a facsimile machine;

(2) color material ejection devices used to manufacture color filters for image display devices, e.g., liquid crystal display;

(3) electrode material ejection devices used to form electrodes of, for example, organic EL (electroluminescence) display and field emission display (FED);

(4) fluid ejection devices configured to eject a bioorganic material-containing fluid used for manufacturing biochips;

(5) sample ejection devices used as precision pipette;

(6) ejection devices of lubricating oil;

(7) ejection devices of resin solution;

(8) fluid ejection devices for pinpoint ejection of lubricating oil on precision machinery including watches and cameras;

(9) fluid ejection devices configured to eject transparent resin solution, such as ultraviolet curable resin solution, onto the substrate in order to manufacture a hemispherical microlens (optical lens) used for, for example, optical communication elements;

(10) fluid ejection devices configured to eject acidic or alkaline etching solution in order to etch the substrate; and

(11) fluid ejection devices equipped with fluid consumption head for ejecting a very small volume of droplets of another arbitrary fluid.

The "droplet" herein means the state of fluid ejected from the fluid ejection device and may be in a granular shape, a teardrop shape or a tapered threadlike shape. The "fluid" herein may be any material consumable by the fluid ejection device. The "fluid" may be any material in the liquid phase. For example, liquid-state materials of high viscosity or low viscosity, sols, gel water, various inorganic solvents and organic solvents, solutions, liquid resins and liquid metals (metal melts) are included in the "fluid". The "fluid" is not restricted to the liquid state as one of the three states of matter but includes solutions, dispersions and mixtures of the functional solid material particles, such as pigment particles or metal particles, solved in, dispersed in or mixed with a solvent. Typical examples of the fluid include ink described in the above embodiments and liquid crystal. The "ink" includes general water-based inks and oil-based inks, as well as various liquid compositions, such as gel inks and hot-melt inks.

The invention is not limited to the above embodiments, examples or modifications, but a diversity of variations and

modifications may be made to the embodiments without departing from the scope of the invention. For example, the technical features of the embodiments, examples or modifications corresponding to the technical features of the respective aspects described in SUMMARY may be replaced or combined appropriately, in order to solve part or all of the problems described above or in order to achieve part or all of the advantageous effects described above. Any of the technical features may be omitted appropriately unless the technical feature is described as essential herein.

What is claimed is:

1. A cartridge configured to supply a printing material to a printing device and configured to mount to the printing device in a state of attachment, the cartridge comprising:

a printing material container adapted to contain the printing material;

a printing material supplier that supplies the printing material contained in the printing material container to the printing device when in the state of attachment;

a first surface, which is the leading surface when mounting the cartridge into the state of attachment, the first surface defining a substantially vertical plane when in the state of attachment and a second surface that is opposed to the first surface;

a third surface defining a horizontal plane, substantially perpendicular to the first surface, that intersects with the first surface and the second surface;

a fourth surface that is opposed to the third surface and positioned above the third surface when the cartridge is in the state of attachment;

a cartridge-side engagement structure that is provided on the third surface at a position closer to the first surface than to the second surface and is configured to be engaged with a device-side engagement structure of the printing device when in the state of attachment; and

contact portions that are provided in an area where both an end of the first surface proximate to the fourth surface and an end of the fourth surface proximate to the first surface are located and are configured to be in contact with the printing device when in the state of attachment, wherein a contact surface defined by the contact portions is inclined to the fourth surface.

2. The cartridge according to claim **1**, further comprising:

a fifth surface that intersects with the first surface, the second surface, the third surface and the fourth surface;

a sixth surface that is opposed to the fifth surface; and

a plurality of terminals, each comprising one of the contact portions, wherein

the contact portions are arranged to form at least one array in a width direction in which the fifth surface and the sixth surface are opposed to each other,

the plurality of terminals include a first terminal having a first contact portion located at a center of the array, and

an engagement portion which is a portion of the cartridge-side engagement structure to be engaged with the device-side engagement structure is located on a virtual plane, the virtual plane passing through the first terminal and being perpendicular to the width direction.

3. The cartridge according to claim **2**,

wherein the printing material supplier includes a supply port at one end, the supply port being located at the first surface at a position on the virtual plane.

4. The cartridge according to claim **2**,

wherein the first contact portion is located at a position on the virtual plane.

5. The cartridge according to claim **1**,

wherein the printing material supplier includes a supply port at one end, the supply port being located at a position closer to the third surface than the fourth surface.

6. The cartridge according to claim **1**,

wherein the third surface has: a one-end-side face that is connected with the second surface; and an other-end-side face that is connected with the first surface and is located at a position closer to the fourth surface than the one-end-side face, and

the cartridge-side engagement structure is formed on the other-end-side face.

7. The cartridge according to claim **1**,

wherein the printing device comprises a flow tube and the printing material supplier is configured to connect to the flow tube; and the printing device also comprises a printing material receiver that traps the printing material, and

the printing material supplier includes a supply port at one end, the supply port located above the printing material receiver in a state just prior to engagement of the cartridge-side engagement structure with the device-side engagement structure.

8. The cartridge according to claim **7**,

wherein the cartridge-side engagement structure comprises a groove structure formed on the third surface, and

the cartridge-side engagement structure comprises:

a receiver portion that is extended from the first surface toward the second surface and is configured to receive the device-side engagement structure; and

a guide portion that is connected with the receiver portion, is extended in a direction inclined to a direction of attachment of the cartridge in a course of attachment of the cartridge to the printing device and is configured to guide the device-side engagement structure to an engagement position where the device-side engagement structure is engaged with the cartridge-side engagement structure, wherein

the guide portion is shorter than the printing material receiver in a direction in which the first surface and the second surface are opposed to each other.

9. The cartridge according to claim **1**,

wherein the printing device comprises: a flow tube that receives the printing material; and a printing material receiver that traps the printing material, and

the printing material supplier includes a supply port at one end, the supply port and the third surface coming to a positional relationship where the printing material receiver is between the supply port and the third surface in a state just prior to engagement of the cartridge-side engagement structure with the device-side engagement structure.

10. The cartridge according to claim **1**, further comprising:

a container main body that defines the first surface to the fourth surface and accommodates the printing material container inside thereof, wherein

the container main body comprises:

a first container body that includes the first surface but does not include the second surface; and

a second container body that includes the second surface but does not include the first surface and is configured to be detachable from the first container body, wherein

the cartridge-side engagement structure is formed on the first container body.

11. The cartridge according to claim 10,
wherein the first container body has a projection protruding toward the second container body, wherein
at least part of the cartridge-side engagement structure is formed on the projection, and the projection and the second container body have play therebetween.

12. A printing material supply system, comprising:
the cartridge according to claim 1; and
a printing device that has a flow tube that is to be inserted into the printing material supplier, wherein
the printing device comprises:
a device-side engagement structure that is to be engaged with the cartridge-side engagement structure; and
a contact mechanism that is to be in contact with the contact portions.

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